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EPA FACILITIES MANUAL, VOLUME 4

4844 Facility Safety, Health, and Environmental Management Manual

Foreword

The *EPA Facilities Manual* is comprised of four distinct, yet complementary resources for planning and managing Environmental Protection Agency (EPA) facilities. These four volumes are meant to be used simultaneously to determine design intent, requirements, and the ongoing evaluation of all EPA facilities. The use of one volume without reference to the other three would result in an incomplete understanding of the requirements for EPA facilities.

Volume 1: The *Architecture, Engineering, and Planning Guidelines* (referred to as the *AE&P Guidelines*) provides guidance for facilities management, engineering, planning, and architecture professionals in the design and construction of new EPA facilities and the evaluation of existing facilities.

Volume 2: *Space Guidelines, Volume I* contains information on space planning, space estimation, environment, materials, furniture, process, and maintenance. EPA's Office of Administration and Resources Management developed this document to help EPA facilities managers, space managers, and line personnel plan and use their space.

Volume 3: *Space Guidelines, Volume II* is a technical handbook describing EPA's mission and providing space standards, information on technical considerations and materials safety, and other related documents. It is also intended for use by EPA facilities managers, space managers, and line personnel.

Volume 4: The *Facility Safety, Health, and Environmental Management Manual* (referred to as the *Safety Manual*) outlines safety, health, and environmental management considerations for owned or leased EPA facilities. The Manual's goal is to maintain a safe and healthful workplace that protects against injury, illness, and loss of life.

Facility Safety, Health, and Environmental Management Manual

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Appendices

Chapter 1 - Authority, Policy, and Responsibility

C O N T E N T S

Chapter 1 - Authority, Policy, and Responsibility

1. Purpose

The purpose of this Manual is to detail safety, health, and environmental management considerations for facilities that are owned, leased, or occupied by the Environmental Protection Agency (EPA).

2. Overview

The considerations or criteria in this Manual describe the full scope of the facility features required in EPA-occupied facilities to maintain a safe and healthful workplace, and may exceed local codes or federal standards, which generally describe minimum requirements necessary to protect against injury, illness, and loss of life.

3. Scope

The facility safety, health, and environmental management criteria described in this Manual apply to facilities owned or leased by EPA, and facilities assigned to EPA by the General Services Administration (GSA) or other government agencies. In this Manual, owned and leased facilities shall be referred to as "EPA facilities." The criteria in this Manual, along with the criteria in the *Architecture, Engineering, and Planning Guidelines* (the *"AE&P Guidelines"*), are mandatory for new construction or new leased space. Where meeting these criteria at existing facilities does not seem feasible, consult the Architecture, Engineering and Real Estate Branch (AEREB) for advice or a waiver. Under special circumstances, a waiver may be granted by the Safety, Health and Environmental Management Division (SHEMD).

4. Authority

Authority for the criteria set forth in this Manual is based on the latest approved editions of the following codes, references, and standards. Years and publication dates specifically stated in this Manual reflect the version in use when the revised version of this Manual was written and published. When using the referenced standards listed below, ensure that the latest edition or version is current and has not been superseded.

a. Occupational Safety and Health Act of 1970.

b. 29 CFR Part 1910, General Industry Standards.

c. GSA, Facilities Standards for the Public Buildings Service (PBS-PQ100.1).

d. EPA manuals, Executive Orders, Directives, and SHEMD program requirements.

e. Model building codes, such as the National Building Code of the Building Officials and Code Administrators International, Inc. (BOCA), Uniform Building Code (UBC) of the International Conference of Building Officials, and the Standard Building Code (SBC) of the Southern Building Code Congress International (SBCCI).

f. Uniform Federal Accessibility Standards (UFAS).

5. References

The criteria set forth in this Manual are based on the latest approved editions of the following:

a. National Fire Codes of the National Fire Protection Association (NFPA).

b. *Industrial Ventilation, A Manual of Recommended Practice,* American Conference of Government Industrial Hygienists (ACGIH).

c. Standards of the American National Standards Institute (ANSI).

d. Standards of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

e. *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals,* National Research Council, 1995.

f. EPA *Safety, Health, and Environmental Management Guidelines.*

g. Title III Standards for the Americans with Disabilities Act (ADA) of 1990.

h. Executive Order 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction.

i. Executive Order 12941, Seismic Safety of Existing Federally Owned or Leased Facilities.

j. Standards for Bio-Safety Cabinets of the National Sanitation Foundation (NSF).

Appendix A, List of Standards and References, provides a more comprehensive list of the sources mentioned in the Manual. In addition, a glossary is included as Appendix B to facilitate understanding of the terminology used throughout the Manual.

6. Policy

EPA-occupied facilities shall comply with the requirements provided by the EPA, NFPA, Occupational Safety and Health Administration (OSHA), GSA, and state and local building and fire prevention codes. If conflicts exist between state or local criteria and the criteria set forth in this Manual, the more stringent criteria shall apply. If there are conflicts between the local code and a model code, the discrepancy will be brought to the attention of AEREB and SHEMD for resolution.

7. Objectives

Safety, health, and environmental management criteria are provided for EPA facilities in order to establish the following objectives:

a. Providing reasonable safeguards against injury, occupational illness, and loss of life.

b. Preventing fire exposure, public health hazards, and environmental damage to the communities that surround EPA facilities.

c. Preventing loss of government real and personal property.

d. Preventing interruption of government operations.

e. Promoting the health, well-being, and productivity of occupants.

f. Ensuring that EPA facilities remain in compliance with applicable environmental regulatory standards to preserve environmental quality.

g. Promoting successful integration of environmental requirements into facility design processes to prevent pollution and support EPA's goal of environmental stewardship.

8. Responsibilities

This section describes the responsibilities assigned to divisions or departments within EPA for enforcing the criteria set forth in this Manual.

a. AEREB is responsible for ensuring that the design and construction of EPA facilities comply with local codes as well as with the criteria described herein.

b. AEREB and SHEMD are jointly responsible for ensuring that EPA facilities provide safe, healthful, and environmentally sound work spaces for EPA personnel.

c. AEREB and SHEMD are jointly responsible, when appropriate, for reviewing and approving requests for a waiver for variances or exceptions to the criteria set forth in this Manual. The following criteria apply to requests for variances:

(1) Requests for variances to the criteria described in this Manual must be submitted in writing to AEREB and SHEMD for review.

(2) Documentation of granted variances must be maintained by the facility as long as applicable.

d. AEREB and SHEMD are jointly responsible for updating this Manual, as necessary, to reflect changes in technology and recognized standard practices in safety, health, and environmental management relative to EPA facilities.

9. Requirements

To meet the policy and objectives set forth above:

a. AEREB, with SHEMD's assistance, will review the criteria set forth in Programs of Requirements (PORs) and Solicitations for Offers (SFOs) for new EPA facilities, and for modifications to existing facilities, before awarding a design contract.

b. At significant design and construction points, AEREB, with SHEMD's assistance, will review, approve, and comment on the design plans and construction drawings for new and modified facilities.

c. During construction, a representative acceptable to SHEMD shall inspect the critical safety, health, and environmental management features of a new or modified facility, such as fume hoods, sprinkler systems, and fire alarms, against the design and construction specifications. These features also shall be acceptance-tested against the design and construction specifications prior to occupancy.

d. AEREB, with the assistance of SHEMD, shall inspect and test leased spaces against the criteria contained in this Manual before signing the lease and shall document these criteria in the lease where appropriate.

e. All newly occupied facilities shall be evaluated for environmental problems before occupancy. This evaluation shall include a record search and an audit, including an inspection for underground storage tanks, asbestos, radon, lead, and other environmental threats. (See *Guidelines for Transferring EPA Real Property,* March 1996.)

Chapter 2 - Basic Fire Safety Standards

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Chapter 2 - Basic Fire Safety Standards

1. Purpose

This chapter provides the basic structural fire safety criteria for fire-resistance ratings, types of construction, and utilities.

2. References

Unless otherwise specified herein, all building materials and structural components and assemblies shall conform to the applicable requirements of the following American Society for Testing and Materials (ASTM) test methods and the National Fire Protection Association (NFPA) standards:

a. Standard Methods of Fire Tests of Building Construction and Materials (ASTM E 119/NFPA 251).

b. Standard on Types of Building Construction (NFPA 220).

c. Standard for Fire Walls and Fire Barriers (NFPA 221).

d. Installation of Sprinkler Systems (NFPA 13).

e. Fire Doors and Windows (NFPA 80).

f. Standard Methods of Fire Tests of Door Assemblies (ASTM E 152/NFPA 252).

3. Fire-Resistance Ratings

The fire-resistance hourly ratings shall be determined in accordance with ASTM E 119/NFPA 251. Floor-ceiling assemblies shall be in accordance with the criteria set forth in Section 9 of the *Architecture, Engineering, and Planning Guidelines* (the *"AE&P Guidelines"*). The hourly ratings for various materials and designs shall be obtained either by actual fire testing or by conformance to designs listed by Underwriters Laboratories, Inc., or Factory Mutual.

4. Types of Construction

The various types of construction are defined in NFPA 220 and the model building codes (see Chapter 1 of this Manual, paragraph 4.e, for a list of the model building codes). The construction classifications that use both the NFPA and local building code methods shall be indicated on design documents as applicable. Identification of construction classifications is required in order to meet both the local building code criteria and the criteria of the Environmental Protection Agency (EPA), the General Services Administration (GSA), and the

NFPA standards. The type of construction shall be selected on the basis of the classification of the occupancy (refer to NFPA 101, Chapter 4), as well as the height and area of the building. For further information on design and construction specifications for EPA facilities, refer to Section 1 of the *AE&P Guidelines*.

5. Fire Walls and Fire Barrier Walls

Fire walls shall be used as dictated by the local building codes. For details, refer to Section 13 of the *AE&P Guidelines*.

Fire barrier walls, also known as fire partitions or fire separations, normally have less fire resistance than do fire walls and fail to meet one or more of the requirements for a fire wall. The fire resistance of a fire barrier wall generally depends on the wall's intended use and the degree of fire potential. These walls are used to create fire areas, protect specialized occupancies, or provide protected egress paths.

See Section 13 of the *AE&P Guidelines* for treatment of openings in fire walls and fire barrier walls.

6. Vertical Openings and Shafts

Refer also to Section 13 of the *AE&P Guidelines*.

a. Atriums. Because of atrium smoke control requirements, atrium hazard-level requirements, and the need to maintain liquid-tight floors in laboratories, laboratory rooms shall not open into an atrium. For further details, refer to Section 13 of the *AE&P Guidelines*.

   Occupancies located within an atrium and opening into an atrium must have low or ordinary hazard contents as defined by NFPA 101. Atriums should not be used as a required means of transporting chemicals or laboratory waste materials.

b. Shafts. Refer to Section 13 of the *AE&P Guidelines*.

c. Monumental Stairs. Refer to Section 13 of the *AE&P Guidelines*.

d. Escalators. Refer to Section 14 of the *AE&P Guidelines*.

e. Penetrations. Refer to Section 13 of the *AE&P Guidelines*.

7. Panel, Curtain, and Spandrel Walls

For details, refer to Section 7 of the *AE&P Guidelines*.

Windows. There shall be no operable windows in:

a. EPA laboratory rooms.

b. Other locations where they may interfere with temperature or humidity control or create undesirable airflows.

For additional details, refer to Section 8 of the *AE&P Guidelines*.

8. Ceilings

Suspended ceilings shall not be considered part of a fire-resistive assembly in laboratory areas. The routine operation and maintenance of laboratories require periodic access to the space above the suspended ceiling. It has been the experience of EPA that a rated floor-ceiling assembly is not a design that can be reasonably maintained as a fire-resistive assembly over the life of the laboratory.

9. Fire Stopping

Fire stopping shall be provided in all penetrations through walls, partitions, openings between exterior walls and floor slabs, and openings in floors and shaft enclosures, to form an effective fire and smoke barrier between stories and between horizontal compartments. The installation, testing, and rating of fire-stopping materials and methods (through-penetration protection system) shall be in accordance with NFPA 221. The materials used shall be capable of maintaining the fire resistance of the assembly being penetrated.

10. Fire Doors

Refer to Section 8 of the *AE&P Guidelines*.

11. Utilities

Pipes, wires, cables, ducts, and other utilities or services shall not be embedded in or between the required fireproofing and structural members unless the assembly has been tested and has achieved the required fire resistance. (See paragraph 9 of this chapter for requirements relating to penetration of utilities through fire-resistive assemblies.)

A 1-inch or smaller steel conduit with wiring to clocks, receptacles, telephones, thermostats, or switches may be embedded in the fireproofing if the necessary thickness of fireproofing is not reduced. In such cases, electrical boxes shall be steel, limited to 4-inch nominal size, securely anchored in place, and located at least 2 feet apart or on opposite sides of the structural member.

Chapter 3 - Specific Fire Safety Criteria

C O N T E N T S

Chapter 3 - Specific Fire Safety Criteria

1. Purpose

This chapter describes specific fire safety criteria for various groups of occupancies, open-plan office space, and building attachments.

2. Classification of Occupancies

Occupancies are classified by a number of methods depending on the code or standard used and the purpose of the classification. Methods of classification are presented in Chapter 4 of National Fire Protection Association (NFPA) 101, Chapter 2 of NFPA 45, Chapter 1 of NFPA 13, other NFPA codes and standards that may apply to specific situations, and local building and fire prevention codes. These classifications are used in the application of the respective codes and standards and should not be translated to other codes or standards unless directed. For example, Class B laboratory, as defined in NFPA 45, has no meaning in NFPA 101; however, NFPA 45 specifies that sprinklers in Class B laboratories should be treated as an Ordinary Hazard Group 2, which is defined in NFPA 13. The basis of these classifications varies with each code or standard. Some of the methods of classification are listed below.

a. NFPA 101 classification is based on use of the building or area considered. Examples are business, assembly, and industrial occupancies.

b. Model building code classification is based on use of the building or area considered. Examples are Use Group B (business), S-1 (moderate hazard storage), and F (factory and industrial) as defined by the Building Officials and Code Administrators International, Inc. (BOCA) National Building Code.

c. NFPA 13 classification is based on the degree of fire hazard represented by the use of the building or area to be protected by sprinklers. Examples are Light Hazard and Ordinary Hazard Group 2.

d. NFPA 45 classification is based on the amount of flammable liquids per floor area present in a laboratory unit. Examples are Class A, Class B, and Class C.

e. NFPA 231 classification is based on the type of materials stored and their burning characteristics.

The General Services Administration (GSA) also has one special occupancy classification referred to as high-severity occupancy, which includes storage areas larger than 1,000 square feet with racks or shelves taller than 12 feet, libraries with stacks taller than 9 feet, and record or archive centers with open file shelves. The special design considerations outlined in

PBS-PQ100.1 must be followed for these occupancies. Further details regarding classification of occupancy can be found in the standards referenced above.

Each code or standard must use the classification designations contained in that code or standard. For example, a Class B laboratory as defined by NFPA 45 could be either Use Group B (business) or H (high hazard) as defined by the BOCA National Building Code, and either industrial or high hazard as defined by NFPA 101. Therefore, since the classification of laboratory space by the three codes would differ, the applicable codes and standards with their respective classifications must be clearly identified on the design documents. In addition, the contractual documents shall require that these classifications be indicated in the construction documents, as-built drawings and specifications. For example, the following list could represent the occupancy classifications for a single laboratory project.

NFPA 45	Class B Laboratory
NFPA 101	Industrial
BOCA	Business
NFPA 13	Ordinary Group 2
NFPA 10	Ordinary Hazard

If there is no local building code or if the local building code is not based on one of the three model building codes (i.e., BOCA, Standard Building Code, or Uniform Building Code) the designer must select the most appropriate current model building code as a basis for the design. If there are conflicts between the local code and a model code, the discrepancy will be brought to the attention of the Architecture, Engineering and Real Estate Branch (AEREB) and the Safety, Health and Environmental Management Division (SHEMD) for resolution.

3. Automatic Sprinkler–Protected Occupancies

The occupancy classification will often provide a building-code basis for required sprinkler protection. All EPA-owned facilities, and facilities leased by EPA after the effective date of this Manual, are required to have sprinkler protection unless such protection is not economically feasible with respect to mission-continuity cost or with respect to building and content-replacement cost. An analysis shall be performed to justify new facilities with no sprinkler protection. The provision of sprinkler protection (when not required by another code or standard) shall not be used as a basis for reducing other levels of protection provided for that facility. Where a code or standard allows alternatives based on the provision of sprinklers, however, as in NFPA 101, the alternatives allowed for sprinklered space may be applied.

4. Open-Plan Office Space

The fire safety objective in open-plan offices is to maintain adequate egress facilities and a low-risk environment. This objective can be achieved through provision of complete automatic sprinkler protection, limitation of open-plan areas to low-hazard occupancies (such as office space), maintenance of well-marked egress paths, and fulfillment of the requirements of NFPA 101.

5. Types of Construction

The type of construction shall be the one determined to be the most suitable and economical for the occupancy classification and the height and area limitations dictated by the local building code.

6. Height and Area Limitations

Height and area, including the area of any floor of a building, the area between fire walls, and the area enclosed by fire barrier walls and exterior walls, shall not exceed the limits set forth by the local building code. Fire walls and fire barrier walls shall conform to the requirements of the *Architecture, Engineering, and Planning Guidelines* (the *"AE&P Guidelines"*), Section 13. The rating of fire barrier walls shall be as required in the *AE&P Guidelines.* Where more than one group classification of occupancy is housed, the higher group classification shall govern for determining area limitations in accordance with the local building code.

7. Attachments and Additions

Cornices, marquees, and skylights shall be of noncombustible construction. Attachments and additions for the purpose of providing additional space shall conform to the same construction height and area limitations as the base building.

8. Fire Exposure Protection

A fire exposure is any building, structure, yard storage, or industrial operation containing combustible substances that, if involved in a fire, would present a danger to the building being evaluated. Classification of exposure severity and determination of minimum separation distance shall be in accordance with NFPA 80A, Recommended Practices for Protection of Buildings from Exterior Fire Exposures, and the local building code. Requirements for explosion venting should comply with Chapter 5 of NFPA 45 (for laboratories), NFPA 68, and the local building code, whichever is the most stringent. The methods for determining the more stringent requirements shall be documented in the project submittals.

Chapter 4 - Interior Space Planning

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Chapter 4 - Interior Space Planning

1. Purpose

This chapter provides guidance for the planning and design of interior office and special use space in compliance with the safety, health, and environmental laws and regulations governing Environmental Protection Agency (EPA) facilities. It contains design guidance on building materials and components, such as lead-based paint, asbestos, and ceiling systems, and establishes and references the criteria for fire protection features of miscellaneous occupancies, such as trash rooms (to include recycling space), flammable-liquid storage, gas cylinders, electronic equipment, communications equipment, and stages. Refer to the *Architecture, Engineering, and Planning Guidelines* (the *"AE&P Guidelines*") and the references listed below for further technical requirements related to these design issues.

2. References

Unless otherwise specified herein, the safety features of these occupancies shall conform to the applicable requirements of the following National Fire Protection Association (NFPA) standards and other cited references:

a. Installation of Sprinkler Systems (NFPA 13).

b. Flammable and Combustible Liquids Code (NFPA 30).

c. Fire Protection for Laboratories Using Chemicals (NFPA 45).

d. National Fuel Gas Code (NFPA 54).

e. Compressed and Liquefied Gases in Portable Cylinders (NFPA 55).

f. Storage and Handling of Liquefied Petroleum Gases (NFPA 58).

g. Storage and Handling of Liquefied Natural Gas (NFPA 59A).

h. Protection of Electronic Computer/Data Processing Equipment (NFPA 75).

i. Exhaust Systems for Air Conveying of Materials (NFPA 91).

j. Life Safety Code (NFPA 101).

k. *Handbook of Compressed Gases*, Compressed Gas Association, Inc.

l. Federal Property Management Regulations (FPMR), 41 CFR 101-20.

m. *Facilities Standards for the Public Buildings Service* (GSA PBS-PQ100.1).

n. *Criteria for Siting of Laboratory Facilities Based on Safety and Environmental Factors*, prepared for U.S. EPA by Johns Hopkins University, School of Hygiene and Public Health, Peter S. J. Lees and Morton Corn, 1981.

o. *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*, National Research Council.

3. Interior Construction

For technical requirements, refer to the *AE&P Guidelines*, especially (but not limited to) Sections 6, 8, 9, and 10.

a. Lead-Based Paint. Lead-based paints shall not be used in EPA facilities. (See Chapter 7, paragraph 4.g, of this Manual for regulations concerning lead in water.)

(1) When the scope of a construction activity requires sanding, burning, welding, or scraping of painted surfaces, the paint must be tested for lead content before any such activities begin. If any lead is found, appropriate risk-control measures must be implemented in accordance with 29 CFR §1910.1025 and 29 CFR §1926.62 for lead and 29 CFR §1926.353 for ventilation when welding or cutting.

(2) Lead compounds in paints and other interior coatings are of particular concern in child-care facilities. In these facilities, all surface coatings should be tested for lead, and coatings should be removed if they contain lead. (For further guidance, see PBS-PQ100.1 and the EPA publication *Reducing Lead Hazards When Remodeling Your Home*, EPA 747-R-94-002, April 1994.)

b. Off-Gassing. Interior materials and finishes shall be selected to minimize emissions of contaminants and off-gassing of organics and sensitizing vapors. Arrangements must be made to have suppliers store new furnishings and materials in a clean, dry, well-ventilated area until off-gassing of volatile organic compounds (VOCs) has diminished, but for no less than 2 days. See Section 15 of the *AE&P Guidelines* for more information on heating, ventilation, and air-conditioning (HVAC) performance.

(1) Manufacturers should be consulted for information on the off-gassing characteristics of their products. Information supplied shall be in accordance with the *Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products* (American Society for Testing and Materials [ASTM] Guide D-5116-90) and *Indoor Air Sources: Using Small Environmental Chambers to Characterize Organic Emissions from Indoor Materials and Products* (EPA Report 600/8-89-074).

(2) Materials shall be selected, insofar as this is feasible, to minimize particle release and biological growth media.

c. Asbestos. Asbestos, and facility-related products that contain asbestos, shall not be installed in any EPA facility. Existing asbestos shall be managed in accordance with the EPA publication *Policy and Program for the Management of Asbestos-Containing Building Materials at EPA Facilities* (July 1994). Specific procedures related to asbestos-containing materials (ACM) are as follows:

(1) Ensure that the facility has been inspected for ACM in accordance with the EPA publication *Guidance for Controlling Asbestos Materials in Buildings* (560/5-85-024), 29 CFR §1926.58, and 40 CFR Part 61, Subpart M). Ensure that leased space is, or has been, inspected or certified for the presence of asbestos.

(2) If ACM is present, and if it is in good condition and is not likely to be disturbed, ensure that a management program is implemented to manage the asbestos in place in accordance with the EPA publication *Managing Asbestos in Place: A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials* (20T-2003, July 1990).

(3) If ACM is present and is not in good condition or is likely to be disturbed during routine operations or construction activities, the asbestos must be abated in accordance with the EPA publication *Managing Asbestos in Place: A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials* and the criteria contained in 29 CFR §1926.58.

(4) Ensure that a prealteration asbestos assessment is performed, supplementing available information as appropriate, for any activity that may disturb any ACM. Conduct the asbestos assessment in accordance with the guidelines and requirements mentioned above. (See Chapter 7, paragraph 3.b, of this Manual for additional information regarding removal of ACM.)

4. Exit Facilities

Except as noted below or elsewhere in this Manual, the provisions of NFPA 101 shall be followed.

a. Number of Exits. At least two separate exits shall be available on every floor. Exits shall be as far away from each other as possible and shall be arranged to minimize the possibility that both may be blocked during an emergency.

b. Emergency Egress. Emergency egress paths from the building shall be maintained whenever the building is occupied.

c. Exit Stairs. All exit stairs in new construction, and all exit stairs added to existing buildings, shall conform to the requirements in NFPA 101 for Class A stairs and shall have a minimum width of 44 inches.

d. Exit Merging. Where means of egress from stories above and below converge at an intermediate story, the capacity of the means of egress from the point of convergence shall be at least the sum of the two individual stairway capacities.

e. Exit Doors. All exit stair doors and all other doors opening onto exit routes, except those opening directly to the outside, shall be self-closing or shall be automatically released by smoke detectors. Doors shall be located or recessed to ensure that they do not swing to impede pedestrian flow in corridors or other egress routes. In new laboratories and where required by NFPA 101, NFPA 45, or other codes or standards, exit and exit-access doors shall swing in the direction of egress. Vision panels, in accordance with NFPA 80, should always be provided in stairway and horizontal exit doors and anywhere else where they are necessary for alleviation of potential personnel traffic hazards.

f. Distance Between Exits. Where two exits or exit-access doors are required, they shall be as far away from each other as possible, in accordance with the local building code or NFPA 101, whichever requirement is more stringent.

g. Latches. Latches on stair doors shall be operable from both the stairs and the occupied space side of the doors. In no instance shall doors at the top (or next to the top) and the bottom stair levels be secured. For security reasons, ingress may be restricted as follows as long as such restriction does not impede emergency egress:

(1) The door may open directly to the exterior.

(2) The door may open from a stair to an exit-access door (e.g., lobby or courtyard) to the outside.

(3) An individual stair door may be locked against ingress from the stairway when this decision has been fully justified in writing and where no other reasonable means can be developed to provide necessary security.

Each secured door shall be clearly marked and directions shall be posted showing the nearest floors, above and below, where reentry can be made. In buildings that are equipped for relocation of personnel via a voice fire-alarm system, the use of secured doors and the mode of reentry shall be coordinated (e.g., reentry into the building must be coordinated because the door becomes secure after the fire alarm resets).

h. Open-Plan Office Space. The following conditions shall be met for emergency egress in open-plan office space:

(1) The space layout shall ensure maintenance of rational exit routes with well-marked secondary exits.

(2) Color dynamics (e.g., colored lines, walls) and other innovative directional guidance may be needed in large installations.

(3) The height of dividers and acoustical partitions should be limited (discussed in Section 6 of the *AE&P Guidelines*), and partitions should be arranged to allow air circulation and permit occupants to quickly identify problems that may arise from fire in the area and to locate available exit routes. Partitions taller than 5½ feet, which would obstruct view of the open-plan space, should be avoided where possible or limited to the periphery.

(4) Freestanding space dividers shall resist an overturning force of 25 pounds perpendicular to the face applied at a height of 60 inches above the floor and shall be arranged so as not to interfere with egress.

i. Corridors. The width of any corridor serving as a required exit or as a means of travel to or from a required exit shall not be less than 44 inches clear width. Obstructions such as partitions, columns, doors, and other projections shall not impinge on the 44-inch clearance. The width of passageways will comply with NFPA 101.

Except in open-plan office space, continuous corridors shall be provided connecting to every exit. (Continuous corridors connect exits in such a way that access to all the exits can be gained without leaving the corridor system.)

The fire resistance of exit-access corridors shall be in accordance with NFPA 101 and the local building code.

j. Exit Discharge. Except as provided below, and as detailed in NFPA 101, every exit stair shall discharge directly to the outside or to a protected corridor leading directly to the outside. A protected corridor shall consist of a totally unoccupied passageway or other space, such as a lobby, separated from all occupied areas by fire barrier walls with 1-hour or greater fire resistance; all doorways in these walls shall be protected by Class C or higher fire doors that either are self-closing, or automatic closing and controlled by ionization smoke detectors located on the occupied side of the wall.

k. Two-Doorway Discharge. When a stair discharges through two separate doorways into two separate fire areas at ground level, exit passageways are not necessary. Under these conditions, appropriate markings shall be provided within the stairwell to indicate each exit and the availability of alternate exits. For example, the sign over an exit door might read, “Exit to Main Street,” and a clearly visible sign nearby would read “Exit to Market Street - Down One Floor.”

l. Panic Hardware. Panic hardware (e.g., metal bar on exit door) may be used anywhere, but it must be used for all doors that exit to the outside and all interior-latched exit doors from classrooms, theaters, and other places of assembly with a capacity of more than 100 people.

m. Smokeproof Towers. Smokeproof towers that conform to the requirements of NFPA 101 are acceptable but are not required unless specified by the local building code.

n. Timed Exit Calculation. Egress from buildings or to an area of refuge shall be in accordance with timed calculations.

(1) Personnel in the fire area can travel toward the fire for no more than 15 seconds.

(2) Personnel in the fire area should be able to relocate from the fire area within 90 seconds.

(3) Unimpeded horizontal movement is calculated at 3½ feet per second.

(4) It should take no longer than 8 minutes to exit downward or upward to the outside of the building.

o. Fire Areas/Subdivisions. Fire areas or subdivisions may be developed to improve life-safety conditions in buildings where complete correction of existing stair and exit deficiencies is not feasible. Fire areas/subdivisions may be used to develop horizontal exits in cases where large numbers of handicapped occupants must be provided with safe exit facilities. Fire areas/subdivisions may be used in conjunction with a smoke-control system. Unless greater fire resistance is required for other purposes, fire barrier walls installed to improve existing exit facilities, or for smoke control, shall be of 1-hour fire-resistive construction. A higher fire-resistance rating should be used to enclose such areas as horizontal exits and areas of refuge.

p. Fire Escape. Fire escape stairs, as defined in NFPA 101, are not an acceptable component of the means of egress.

q. Limited Access Areas. Areas such as storage rooms with limited or no ventilation shall be evaluated to ensure the reliability of the exits. If blocking a single exit could create a hazardous condition, provisions will be made either to prevent the exit from being blocked, to provide a means of communication from inside the space, to provide adequate ventilation, or to otherwise prevent the area from becoming a confined space as defined by 29 CFR §1910.146. Refer to paragraph 5.b of this chapter for ventilation requirements for storage rooms.

5. Hazard Segregation

In general, occupancies posing different levels of risk shall be separated by fire-resistive construction. Areas shall be segregated as noted below and as required by local building codes and NFPA 101. Refer to Sections 1 and 2 of the *AE&P Guidelines* for technical requirements concerning parking structures.

a. Assembly Areas. Because of the high number of occupants permitted in auditoriums, cafeterias, and other places of assembly, it is necessary to provide appropriate protected egress paths from these locations to the outside of the building. Whenever possible, such occupancies shall be located on the exit level of the building, or on a floor close to the level of exit. See NFPA 101, Chapters 8 and 9, for minimum egress requirements.

b. General Storage Areas. Storage areas shall comply with NFPA 101. All areas used for storage of maintenance supplies, pesticides, solvents, paints, art supplies, or other materials that may contain VOCs shall be equipped with adequate exhaust and shall have no air recirculation. In addition, these areas shall meet the requirements for indoor air quality in GSA's PBS-PQ100.1. At a minimum, any such storage area shall be separated from adjacent spaces with fire-resistive construction or protected with sprinklers as required by NFPA or the local building code.

c. Ancillary Occupancies. Ancillary or accessory occupancies are occupancies that take up approximately 10 percent or less of a building's overall area. Ancillary occupancies do not have to be segregated with fire separations from other occupancies. The means of egress, construction, protection, and other safeguards shall be determined by the requirements of the predominant occupancy. See paragraph 15 of this chapter for special provisions for laboratory areas that are intermingled with offices.

d. Mixed Occupancies. Mixed or intermingled occupancies are areas in which two or more classes of occupancy coexist in such a way that separate safeguards are impracticable. In such cases, the means of egress, construction, protection, and other safeguards shall be based on the occupancy that demands the more stringent requirements. See paragraph 15 of this chapter for special provisions for intermingling laboratory areas and offices.

e. Blind Stands and Self-Service Stores. Blind stands and self-service stores shall be separated from the remainder of the building by 1-hour fire-rated enclosures and doors. If the entire floor is protected by automatic sprinklers, fire-rated enclosures are not needed.

6. Day-Care Facilities

Day-care centers must comply with NFPA 101, Life Safety Code, as well as EPA's guidelines, GSA's *Child Care Center Design Guide* (PBS-PQ140), and the licensing requirements of the local jurisdiction. Minimum requirements are described below.

a. Day-care centers must be located along a grade-level exit discharge and along an outside wall with operable windows. Preferably, there should be a door leading directly outside from the day-care center.

b. All toys; articles of furniture; equipment for play, amusement, education, and physical fitness; and other products used for care of children shall have nontoxic paints or coverings. Additionally, potable-water distribution systems shall be tested to ensure that there are not excessive levels of lead. (See Chapter 7, paragraph 4, of this Manual for requirements for drinking water.)

c. The day-care center shall not be located in an area with asbestos-containing materials, lead-based paints, or polychlorinated biphenyls (PCBs). Paint, and similar surface-coating materials, that contain mercury, asbestos, lead, or lead compounds are prohibited.

d. The day-care center must be separated from the rest of the building by at least 1-hour fire-resistive construction with 45-minute fire doors.

e. Smoke detectors must be installed throughout the day-care center, including interior corridors, sleeping areas, and lounges. Refer to Section 16 of the *AE&P Guidelines* for specific technical data concerning smoke detectors.

f. No higher hazard areas, such as laboratories, shall be located in the same fire area as the day-care center. All higher hazard areas shall be separated from the day-care center by at least 2-hour fire-resistive construction regardless of sprinkler protection. Laboratories and other hazards shall not be located where they could present a hazard to occupants of the day-care center or expose the egress routes from the day-care center to hazard.

g. Emergency lights and exit signs shall be provided for the day-care center and associated egress routes.

h. The travel distance to an exit-access door from any point within any sleeping room must not exceed 50 feet. The travel distance to an exit from any door used as an exit-access must not exceed 100 feet. The travel distance from any point in a room to an exit must not exceed 150 feet. Increased travel distances due to sprinkler protection shall be allowed in accordance with NFPA 101 31-2.6.

i. The center must be provided with sufficient physical security to prevent entry by unauthorized persons.

j. All unused electrical receptacles within reach of preschool children must be equipped with socket guards.

k. Lockable storage spaces for toxins, such as cleaning materials, must be provided. Additionally, there must be shelving in the locked storage area that is out of reach of preschool children.

l. All articles of furniture and equipment for play, amusement, education, physical fitness, and care of children shall be constructed and finished to minimize pinch points and splinters. The spacing of crib and bed slats presents special safety concerns and should meet the requirements of 16 CFR Parts 1145, 1508, and 1509.

m. A means must be provided to limit hot water temperature to 120 degrees Fahrenheit in fixtures that are accessible to children. In addition, water fixtures that are accessible to children should be of the "mixer" type to limit the temperature of the water.

n. A means must be provided to prevent children from gaining access to the kitchen area.

o. Fans must be located at least 7 feet above floor level, and the fan blades must be guarded.

p. All forms of electric or fueled portable space heaters are prohibited.

q. Outside play areas shall be so located and secured as to minimize exposure of children to unauthorized persons, vehicular traffic (consider also the possibility of runaway vehicles), animals, overhead electrical power lines, and overspray from HVAC cooling tower water.

r. The facility's occupant emergency plan must specifically address the day-care center, and all employees of the center must be trained and proficient in executing the plan.

7. Safety of Disabled

The safety attributes of EPA facilities must take into account the special needs of disabled individuals. Compliance with Federal Standard 795, Uniform Federal Accessibility Standards (UFAS), is mandatory on all EPA projects. Because the Americans with Disabilities Act (ADA) is a more contemporary document, the requirements of ADA Title III standards shall be followed where those requirements are more strict than UFAS standards. This policy is derived from GSA PBS-PQ100.1 and shall remain in effect until the UFAS requirements have been updated and reissued. (UFAS requirements were last updated in 1989.)

a. The criteria below address safety issues relating to general access to EPA facilities. For specific design guidance and requirements related to the following issues, refer to UFAS; ADA; and American National Standards Institute (ANSI) A117.1, *Providing Accessibility and Usability for Physically Handicapped People.*

(1) Fire alarms. Provide visual warning devices to alert the hearing impaired. (Refer to Section 16 of the *AE&P Guidelines* for technical requirements concerning fire alarms.)

(2) Ramps. Examine the slope, length, surface-friction attributes, and exposure to weather of access ramps to ensure that they meet the applicable UFAS, ADA, and ANSI requirements.

(3) Exit paths. Ensure that exit paths are wide enough to permit access by wheelchairs and electrically powered carts. Also ensure that there are no items stored in exit paths that would impede the exit of a person in a wheelchair or an electric cart. See references cited above for minimum clearances; see also subsection 1.5.5.4 of the *AE&P Guidelines*.

(4) Elevator controls. Ensure that the controls and emergency telephones of self-service elevators are within reach of a person in a wheelchair. Technical specifications for elevators are given in Section 14 of the *AE&P Guidelines.*

(5) Fire doors. Ensure that the hardware of fire and exit doors, particularly self-closing fire doors, can be operated by a person in a wheelchair. (Refer to Section 8 of the *AE&P Guidelines* for technical requirements concerning fire doors.)

(6) Occupant emergency plans. These plans shall specifically address the needs of handicapped persons in general, and the particular needs of EPA employees assigned to the facility.

b. The above criteria do not address the occupational exposures of individuals with disabilities. When facility designs are modified to accommodate a disabled person, the facility design attributes will require a careful analysis of the hazards associated with the work to be performed and the specific needs of individual employees. The following list delineates the more common issues to be addressed for individual EPA employees:

(1) Accessibility of emergency equipment, such as emergency showers, eyewashes, and alarms.

(2) Appropriateness, accessibility, transportation, and use of hazardous materials within the facility.

(3) Accessibility of fume hoods, height of work benches, and accessibility of controls on test equipment.

8. Trash Rooms

In any building where combustible trash is expected to accumulate or to be collected in a central location, a properly protected trash room shall be provided. See Chapter 7, paragraphs 5 and 6, of this Manual for requirements for solid and hazardous waste management and petroleum and hazardous substance storage.

a. Trash Room Specifications. Trash rooms shall be enclosed and separated from the remainder of the building by 1-hour fire-resistive construction. The door to the trash room shall be at least a 45-minute self-closing fire door. Trash rooms and any areas used as a staging area for trash collection shall be sprinkler protected. The water supply for the sprinklers in trash rooms or staging areas that are less than 250 square feet in size may be the domestic water system.

b. Recycling. For new construction and new leased space, adequate space shall be provided for collection, segregation, storage, and removal of recyclable, nonhazardous waste. The purpose of providing this additional storage space is to preclude the use of corridors as recycling storage areas, which could obstruct egress paths and increase the fire hazard.

9. Flammable Liquids

Facilities conforming to the requirements contained in NFPA 30 may use and store the flammable liquids that are necessary for operating the laboratory or other facility. Whenever the site arrangements permit, the storage of large quantities of flammable liquids, such as those required to support chemical laboratory operations, shall be separated in accordance with NFPA 30 and local codes.

Chemical laboratory requirements for specific quantities of flammable liquids are outlined in NFPA 45 and are based on the classification of the laboratory unit.

a. Indoor Flammable-Liquid Storage Rooms. An inside storage area for flammable liquids shall be separated from adjacent spaces by at least 2-hour fire-resistive construction. The room shall otherwise comply with the requirements presented in Section 4-4 of NFPA 30 and local building and fire prevention codes. This section applies to new flammable-solvent storage as well as to waste-flammable storage. The room should be vented to the outside atmosphere by a mechanical exhaust system that meets the following criteria:

(1) The ventilation rate must be at least 1 cubic foot per minute of exhaust per square foot of floor area, but not less than 150 cubic feet per minute.

(2) The source of air supply should be within 12 inches of the floor on one side of the room.

(3) Exhaust should be taken from within 12 inches of the floor on the opposite wall of the room from the makeup air.

(4) Exhaust must not be vented into a fume hood or its associated exhaust system.

(5) If ducts are used for the ventilation system, they shall comply with NFPA 91.

If a room is used for mixed waste-chemical storage, proper segregation shall be provided to prevent mixing of incompatible chemicals. This segregation shall include, but not be limited to, diking provisions between storage areas of incompatible chemicals.

b. Laboratory Cabinets. Laboratory cabinets used for flammable-liquids storage must be of a type approved by a nationally recognized testing laboratory. If testing or evaluation identifies that a health hazard exists from the storage of chemicals in the cabinet and administrative controls are ineffective, venting to the outside atmosphere of the cabinets is mandated in order to control the risk. Refer to Chapter 5, paragraph 12, of this Manual for ventilation criteria.

10. Hazardous Chemical Storage

Facilities conforming to the requirements contained in the local building and fire prevention code shall be provided with storage arrangements for hazardous chemicals, other than flammable liquids, that are necessary for the operation of the laboratory or facility and the operations conducted in it. Whenever the site arrangements permit, the storage of large quantities of hazardous chemicals, such as those required to support chemical laboratory operations, should be separated, in accordance with NFPA 30 or local codes, or segregated, in accordance with NFPA 80A. Provisions shall be made for separating incompatible chemicals in storage and for preventing inadvertent intermingling of such chemicals (such as in a drainage system).

a. Indoor Hazardous Chemical Storage Rooms. The inside storage areas for hazardous chemicals shall be in accordance with the requirements for flammable-liquid storage rooms as noted in paragraph 9.a of this chapter. They shall also comply with the local building and fire prevention codes. Hazardous chemical storage shall be separated from flammable-liquid storage by at least 2-hour fire-resistive construction.

b. Laboratory Cabinets. Laboratory cabinets used for hazardous chemical storage must be appropriate for their intended use. Cabinet venting to the outside atmosphere is necessary when health hazard exposures warrant ventilation and administrative controls are ineffective in controlling the risk. When a cabinet is vented, it shall be

vented in accordance with the requirements for flammable-liquids storage cabinet venting as presented in paragraph 9.b of this chapter and paragraph 12 of Chapter 5.

Refer to Chapter 7, paragraphs 5 and 6, of this Manual for applicable requirements for solid and hazardous waste management and petroleum and hazardous substance storage.

11. Flammable and Oxidizing Gases

NFPA standards shall be used as a basis for determining requirements. Depending on the type of installation, standards 50A, 51, 54, 55, 58, and 59A shall be used. The requirements for chemical laboratories are outlined in NFPA 45.

In situations not covered by NFPA standards, the Compressed Gas Association, Incorporated, publications shall be used as guidelines. Flammable gases or liquids shall be separated from oxidizing gases, such as oxygen, compressed air, and chlorine, and from combustible or flammable materials. All containers shall be rigidly mounted in a vertical position and protected against physical damage.

Flammable-gas containers shall be stored outside the building whenever possible, with the gas piped to the workspace as detailed in NFPA criteria. As a last resort, gas containers shall be located inside the building in a ventilated, fire-resistive room conforming to NFPA standards.

12. Gas Cylinders

All cylinders shall be constructed, charged, shipped, and maintained in accordance with applicable Department of Transportation (DOT) specifications and regulations published in 49 CFR Parts 100-177 and NFPA 55.

a. Size and Quantity in Use. Cylinder size and number of cylinders permitted within a facility will depend on system size, room size, construction, room ventilation, cylinder contents, and availability of fire suppression. A gaseous system includes all regulators, relief devices, manifolds, piping, and controls leading from the cylinder to the point of actual use.

   No single flammable-gas or oxygen cylinder shall exceed 220 cubic feet (approximately 10 inches in diameter by 50 inches in length). The total number of flammable-gas and oxygen cylinders in a laboratory shall not exceed the number specified in Chapter 8 of NFPA 45. In general terms, this limitation is six cylinders in a sprinklered space, and three cylinders in a nonsprinklered space, for a 500-square-foot area. (Liquefied flammable gases are limited to three cylinders for a sprinklered space and two cylinders for a nonsprinklered space.)

b. Anchoring of Cylinders. When in place at the point of use, cylinders shall be securely supported in an upright position by a chain, nylon strap, or metal channel assembly attached to a countertop, wall, column, or substantial pipe. Cylinders shall

not be secured to tables or desks that are not attached to the structure. Cylinder stands attached to or near the base of gas cylinders shall not be used.

Restraining points should be above the center of gravity but not so high as to permit the cylinder to slide out. In seismic areas, a second restraining point below the center of gravity shall also be provided. Cylinders must be secured individually. "Gang" chaining shall not be permitted in the laboratory, although this is a permissible practice where gas cylinders are delivered and stored.

c. Supply Lines. Supply lines leading from high-pressure cylinders shall be securely anchored every 5 feet to minimize "whipping" in the event of a line or fitting failure. They shall also meet the pressure relief requirements of NFPA 45.

d. Cryogenics. For the purposes of this section, cryogenic fluid is defined as any substance that exists only in the vapor phase above -73.3 degrees Celsius (-100 degrees Fahrenheit) at 1 atmosphere and is handled, stored, or used in the liquid state at temperatures at or below -73.3°C (-100°F).

(1) Ductility and chemical reactivity of materials must be considered. Accordingly, when selecting facility-related materials for cryogenic use, refer to *The American Society of Mechanical Engineers' Boiler and Pressure Vessel Code*, Section VII.

(2) To reduce the probability of personnel exposure to extreme temperatures, flasks of cryogenic materials shall not be stored or used in corridors or other places to which noninvolved personnel have routine access.

(3) Vent lines should be routed to the outside atmosphere at a location that would preclude a hazardous accumulation of flammable, toxic, or inert gas in the work area.

e. Ventilation. Ventilation rates in any room storing flammable-gas cylinders shall be sufficient to prevent the achievement of the lower explosive limit resulting from minor leakage of a cylinder. See NFPA 55 for required ventilation rates.

f. Labeling. To reduce the probability of inappropriate use, permanent piping and all piping that passes through a wall shall be labeled at the supply point and at each discharge point with the name of the material being transported.

13. Electronic Equipment

Except as noted below or elsewhere in this Manual, the provisions of NFPA 75, Standard for the Protection of Electronic Computer/Data Processing Equipment, shall be followed. The scope of NFPA 75 shall be used to determine applicability of this section.

a. Housing. All operations shall be housed in a building of fire-resistant or noncombustible construction.

b. Separation. All operations shall be separated from other occupancies within the building by 1-hour fire-rated construction.

c. Construction. All materials used in construction shall have a flame spread rating of 25 or less and a smoke development rating of 450 or less. Raised floors shall be of noncombustible construction.

d. Occupancy. Except for small supervisory offices directly related to the electronic equipment operations, no activity shall be located within the fire-rated enclosure.

e. Emergency Accessories. An emergency power off (EPO) button, emergency lights, alarms, strobe lights, and all necessary appurtenances shall be provided as required by NFPA 75.

f. Dry Pipe. Refer to Chapter 5, paragraph 4, of this Manual for sprinkler requirements.

g. Smoke Detectors. Smoke detectors shall be provided at ceilings and in raised floors and for data storage areas, in accordance with NFPA 72. Refer to Section 16 of the *AE&P Guidelines* for details.

h. Vital Records. Important and vital records that have not been duplicated and stored at a different location shall be stored in a room with 2-hour fire-rated enclosure. Automatic sprinkler protection shall be provided for data storage areas. Class 150 1-hour-or-better data storage equipment shall be provided only for vital data that have not been duplicated and that are being stored within the electronic equipment operations area.

i. Air-Conditioning System. See Chapter 5, paragraph 8, of this Manual for details.

j. Shutoff Switches. See Chapter 6, paragraph 17, of this Manual for details.

k. Emergency Lighting. Emergency lighting shall be provided. Refer to Section 16 of the *AE&P Guidelines* for details.

14. Stages

All stages, platforms in auditoriums, and similar arrangements shall conform to the requirements for interior finish contained in this Manual and in Section 9 of the *AE&P Guidelines*. All curtains and draperies for stages and platforms shall be of a noncombustible material, such as fiberglass, or shall be of material impregnated to be flame resistant for the life of the fabric (25 washings).

Stages arranged or intended for theatrical or operatic use that involves movable scenery, rigging loft, and the like shall conform to the requirements listed below.

a. Stages shall be separated from all other parts of the building by fire partitions having at least a 2-hour fire-resistive rating. The proscenium walls shall also have at least a 2-hour fire-resistive rating.

b. The entire stage and all dressing rooms, storage rooms, prop rooms, and other backstage areas shall be protected by automatic sprinklers.

c. The rooms over the stage shall have at least 1-hour fire-resistive construction and shall be provided with emergency venting of not less than one-eighth of the area of the stage.

d. The proscenium opening shall be protected by a standard fire-resistive proscenium curtain arranged for automatic closing without the use of applied power.

e. All interior construction for rigging and lighting shall be noncombustible.

15. Laboratories

Fire safety, personal safety, and health issues in laboratories present a need for careful design and construction to ensure personnel and property protection and efficient operations. It is desirable to consolidate laboratory space into separate fire areas exclusive of other occupancies. Laboratories that handle or store hazardous chemicals, flammable gases, flammable liquids, or explosives, and biological laboratories should not be incorporated into plans for EPA office buildings or into buildings that are being considered for EPA-leased office space. Laboratories shall not be established or expanded in existing EPA buildings that are mainly occupied with office space. Refer to paragraph 9.b of this chapter for additional information on laboratory cabinets.

Refer to Section 1 of the *AE&P Guidelines* for technical data and requirements concerning laboratories.

16. Emergency Equipment and Showers

Emergency showers and eyewashes shall be provided in areas where the eyes or body of an employee may be exposed to hazardous materials, including in hazardous materials storerooms. Eyewashes shall be provided within the immediate vicinity where hazardous materials may contact the eyes. Emergency showers shall be located near areas where hazardous materials are used, preferably inside or just outside the door of each laboratory work area. The National Research Council's *Prudent Practices* calls for eyewashes to be provided where showers are located to allow simultaneous flushing of the eyes and washing of the body. The shower and eyewash should be plumbed to provide a continuous supply of water for at least 15 minutes. Other requirements are discussed below.

a. Eyewashes shall be capable of flushing both eyes simultaneously and shall be initiated by a single action that permits both hands to be free.

b. Emergency showers shall have a single-pull design for actuation.

c. The need for a floor drain for an emergency shower is determined by an assessment of local conditions. Floor drains may be provided for shower systems if laboratory runoff can be intercepted and isolated for disposal or treatment in a wastewater system.

d. Discharge from emergency showers should not impinge on powered electrical equipment.

e. For new laboratory construction, eyewashes in repetitive laboratory modules shall be fully plumbed (supply and drain) to facilitate weekly testing of equipment. In locations where eyewash stations or showers are required but where plumbed-in water or heat is not provided, self-contained units facilitating the above criteria will be allowed upon approval by SHEMD.

Emergency equipment such as fire blankets and hazardous material spill clean-up kits shall be provided in readily available areas or marked storage space and shall be consistently located throughout laboratory areas.

Chapter 5 - Mechanical Systems

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Chapter 5 - Mechanical Systems

1. Purpose

This chapter establishes the safety requirements for building mechanical systems, including laboratory fume hoods and other exhaust devices, water supply systems, automatic sprinkler systems, fire main systems, fire extinguishers, air-conditioning systems, heating equipment, and elevators. Refer to Section 15 of the *Architecture, Engineering, and Planning Guidelines* (the *"AE&P Guidelines"*), for technical requirements and specifications concerning mechanical systems.

2. References

Unless otherwise specified in this Manual or approved by the Architecture, Engineering and Real Estate Branch (AEREB) and the Safety, Health and Environmental Management Division (SHEMD), all mechanical system installations shall conform to the applicable requirements of the National Fire Protection Association (NFPA) and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards and the American National Standards Institute (ANSI) safety codes referenced in the *AE&P Guidelines,* Section 15.

3. Water Supplies

Refer to Section 15 of the *AE&P Guidelines* for technical requirements and specifications.

4. Automatic Sprinkler Protection

Refer to Section 15 of the *AE&P Guidelines* for technical requirements and specifications.

a. Sprinkler Protection for Electronic Equipment. Automatic dry-pipe sprinkler protection may be provided throughout computer rooms that are not associated with laboratory areas. The dry-pipe system shall be provided by means of a dual sensing pre-action sprinkler mechanism and controlled by a deluge valve. The deluge valve will be operated by a control panel to which the associated fire zone smoke detectors will be connected. The sprinkler heads used with the pre-action type system shall be pendant style or may be of the flow control (FC) type.

The pre-action dry type sprinkler system will operate as follows:

Under normal conditions, sprinkler system pipes will be filled with low-pressure air. A check valve mounted immediately above the deluge valve retains the supervisory air pressure. Sprinkler head or sprinkler piping damage causes loss of air pressure, resulting in trouble alarms without operation of the deluge valve.

A two-zoned smoke detection system will be provided (e.g., "zone A" and "zone B"). When a smoke detector from zone A is activated, a warning alarm will sound. If a smoke detector from zone B is activated while the smoke detector from zone A is activated, the control panel will depressurize the pipes, the deluge valve will open, the pipes will fill with water, and the sprinkler heads will activate in accordance with the ambient temperature. Once the deluge valve is activated, the fire alarm system will also be activated, power to computer equipment will be cut off, and the associated heating, ventilation, and air-conditioning (HVAC) equipment will operate under smoke and/or fire mode automatically. Smoke detector actuation shall sound an alarm at the annunciator panel and automatically notify the local fire department or central monitoring station. Other methods of achieving this zoned approach shall be reviewed for acceptance by AEREB.

b. Wet Pipe. Automatic wet-pipe sprinkler protection shall be provided throughout all laboratory areas containing electronic equipment operations areas, including data storage areas (refer to Section 15 of the *AE&P Guidelines* for information about mechanical aspects of automatic sprinkler protection). In accordance with NFPA 13, the sprinkler systems shall be designed to provide 0.10 gallons per minute (gpm) per square foot over 1,500 square feet for electronic equipment areas, and 0.15 gpm per square foot for 3,000 square feet for tape libraries and storage areas that are less than 9 feet above floor level. For storage heights of 9 feet or higher, systems shall be designed to provide 0.18 gpm per square foot for 3,000 square feet. The sprinkler piping may be valved separately, but valves shall be provided with tamper switches connected to the building fire alarm system.

5. Halon-1301 Fire-Extinguishing System

Refer to Chapter 3, paragraph 3, of this Manual and Section 15 of the *AE&P Guidelines* for the provision of alternative fire protection systems. Refer to Chapter 7, paragraph 3.c, for information on removal of halon systems.

6. Gaseous Fire-Extinguishing Systems

Refer to Section 15 of the *AE&P Guidelines* for technical requirements and specifications.

7. Dry-Chemical Systems

Dry-chemical systems stop the chain reaction that occurs in combustion. Dry chemical is difficult to remove from electrical contacts. Use is generally restricted to cafeteria exhaust hoods and plenums, deep-fat fryers, and grills. Preengineered systems are satisfactory for this use. Refer to Section 15 of the *AE&P Guidelines* for technical requirements and specifications.

8. Air-Conditioning Systems

Refer to Section 15 of the *AE&P Guidelines* for technical requirements and specifications.

A separate air-conditioning system should be provided for the electronic equipment operation area. If a system serves other areas, dampers to protect against both smoke and fire shall be provided for the duct work at every penetration of the electronic equipment area fire separation. No other ducts shall pass through the electronic equipment area.

9. Ventilation Systems

Refer to Section 15 of the *AE&P Guidelines* for technical requirements and specifications.

10. Heating Equipment

Refer to Section 15 of the *AE&P Guidelines* for technical requirements and specifications.

Space heaters and portable heaters shall not be used in EPA laboratories, hazardous material storage areas, or administrative spaces. Under extreme circumstances, SHEMD and AEREB will consider a temporary waiver of this requirement. As appropriate, such heaters may be used in remotely located structures, such as otherwise unheated work sheds. Refer to Section 15 of the *AE&P Guidelines* for technical requirements and specifications for portable heaters.

11. HVAC System Performance

a. As set forth in the EPA document *Building Air Quality* (EPA 400/1-91/033) the following indicator levels have been established to help identify situations in which the HVAC system may not be providing optimum performance:

(1) Carbon monoxide. Values higher than several parts per million (ppm) indicate inappropriate presence of combustion by-products.

(2) Carbon dioxide. Peak values exceeding 1,000 ppm indicate underventilation.

(3) Formaldehyde. For all spaces, peak values exceeding 0.1 ppm may produce irritational effects in the normal population.

Refer to Section 15 of the *AE&P Guidelines* for additional technical requirements and specifications concerning indoor air.

b. EPA facilities shall institute and document a maintenance program to ensure that designed HVAC performance levels are maintained. This program, at a minimum, shall address periodic:

(1) Filter cleaning and replacement.

(2) Cleaning and maintenance of the HVAC duct, coil, condensate drip pan, and air-handler room.

(3) Biological testing, or biocide monitoring, of the water in cooling towers and condensate drip pans.

(4) Performance testing, including, but not limited to, fan efficiency, air distribution, and amount of outside air.

Refer to the EPA document *Building Air Quality* (EPA 400/1-91/033) for a model HVAC maintenance program.

12. Laboratory Fume Hoods

The laboratory fume hood is the primary hazard control device that workers depend on for their protection while working with toxic or other hazardous materials. If designed, installed, tested, operated, and maintained properly, the laboratory fume hood will provide personnel with a high degree of protection and allow the user to work with a wide range of potentially hazardous materials.

a. Laboratory Fume Hood Purchase. All fume hood purchases and installations must have written approval from the representatives of AEREB and SHEMD before procurement documents are processed.

b. Laboratory Fume Hood Function. The purpose of a laboratory fume hood is to capture and control contaminants generated inside the hood and to minimize the exposure of laboratory personnel to these contaminants. The fume hood achieves these results by drawing air past the operator, into the hood, through the zone of contaminant generation, through the baffle slots, into the plenum, and out through the stack.

c. Conditions Affecting Laboratory Fume Hood Performance. The ability of a laboratory hood to control contaminants generated in the hood will depend on the hood's location within the laboratory, the movement and amount of supply air in the room, the "face velocity" (or flow of air entering the open area) of the hood, and the movement of people in the vicinity of the fume hood. The proper selection and control of these factors will determine the hood's ability to control hazards.

(1) Hood placement and location. Hoods should be placed in such a way that the operator is generally the only person who enters the hood's zone of influence. Pedestrian traffic past fume hoods should also be minimized. Room data sheets have been developed by SHEMD to assist in the location of laboratory fume hoods during the design of a new laboratory or renovations of existing

laboratories. Copies of room data sheets are presented in Appendix C of the *AE&P Guidelines*.

(2) Air movement in the laboratory. Air movement within the laboratory affects the performance of hoods. Hoods must be located away from doors, operable windows (operable windows should not be designed into a laboratory), and pedestrian traffic. Air currents from these sources can attain velocities several times greater than the hood face velocity, creating a potential for drag out or displacement of contaminated air from the hood. Ceiling and wall diffusers for distributing makeup air also represent potentially serious sources of interference. Air from such outlets should be either controlled to assist in the performance of the hood or directed so that the kinetic energy is lost before the air enters the zone of influence. Experience indicates that air velocity in the vicinity of the fume hood should not exceed 25 feet per minute (fpm) measured with hood exhaust "off." Air drawn from adjacent areas (by the hood exhaust system) must not create excessive turbulence when it enters the hood.

(3) Face velocity. The flow of air entering the open area of a fume hood (face) should be uniform and perpendicular to the face. Air flow rates must be sufficient to provide protection from operations performed in the hood. Competing influences such as supply air currents will affect face velocity.

(4) Hood turbulence. Upon entering the hood, air is drawn past equipment and sources of contamination toward the exhaust slots. Much of the air within the hood is in a turbulent state. Increased turbulence will result from airflows greater than those needed to provide a good vector and contain the contaminant. When turbulence is excessive, it creates the potential for greater mixing of contaminated air and room air at the hood face. Face velocities should not exceed 135 fpm.

d. Fume Hood Systems. The laboratory fume hood is part of an overall system that includes the laboratory work area, the laboratory HVAC system, an exhaust duct system, an exhaust motor and fan, a low-flow warning device, and (sometimes) effluent-cleaning devices. Laboratory workers assume that, if it is used and maintained properly, the hood system will enable them to work with hazardous materials without undue exposure to contaminants generated in the hood. It is essential, therefore, that each portion of the system be chosen carefully. Refer to Section 15 of the *AE&P Guidelines* for additional criteria, technical requirements, and specifications for fume hood systems.

e. New Hood Installations. The laboratory process requiring ventilation should be reviewed, the best location determined, and the hood or other ventilation equipment selected on the basis of its performance capabilities. If a fume hood is required, the conditions in the laboratory that affect hood performance should be studied (refer to paragraph 12.c of this chapter and to the room data sheets in Appendix C of the

AE&P Guidelines. For constant volume bypass or variable air volume (VAV) air-type hoods, the economics of the required heating and air-conditioning equipment and the projected operating costs must also be considered. The HVAC system of the laboratory must be capable of conditioning supply air to the degree required for proper hood performance, maintenance of room temperature and required humidity levels, and operator comfort. A good laboratory hood, when selected, installed, and used as prescribed, allows the worker to handle a wide range of materials, including materials for which extremely low exposures are hazardous. For materials that are suspected or known to be extremely toxic and that require special precautions and equipment, consult SHEMD staff before selecting containment equipment.

When the performance of existing hoods is unsatisfactory, attention should first be directed to achieving the specified hood face velocities. When correct face velocities have been achieved, attention should be directed to external factors such as hood location and room ventilation. When the best environment for the hood has been achieved, the remaining features, such as airfoils, air volume moved, and control of the air pattern in the zone of the operator, should be considered. In some extreme cases, a new fume hood system may be required. Refer to Section 15 of the *AE&P Guidelines* for additional criteria, technical requirements, and specifications.

f. Fume Hood Operation. The hood exhaust fans shall remain in operation at all times when hoods are in use and for a sufficient time thereafter to clean the hoods of airborne hazardous substances. Operation of the hood exhaust system shall be confirmed. A “power on” light may be provided to indicate when the exhaust fan is energized, although this will not provide a sure indication of airflow in cases such as belt failure. Accordingly, the most effective system is a pressure sensor low-flow alarm, which provides an audible and visual signal in case of exhaust system malfunction and provides a continuous indication of proper hood operation. The warning system must be connected to an emergency power source so that the alarm will sound even if electrical power to the hood is lost. Flow monitors shall be installed on all new hoods and on existing hoods that are modified.

g. Ventilation of Laboratory Cabinets. When a cabinet is vented, it shall be vented by a mechanical exhaust system that meets the criteria of NFPA 91 and Appendix A of NFPA 30 as discussed below.

(1) The ventilation rate must be 5 to 20 cubic feet per minute (cfm).

(2) Air should be supplied at the top of a cabinet, exhausted from the bottom, and swept across all the shelves by arranging the shelves as baffles or constructing the shelves of perforated metal.

(3) The inlet fitting should incorporate a flame arrestor.

(4) If a separate exhaust fan is used, it must be roof-mounted and sparkproof, and it should be weatherproof.

(5) The cabinet exhaust must not be vented into a fume hood but may be connected and vented through a fume hood's associated exhaust system if the operations served by that exhaust system are not incompatible with the materials stored in the cabinet.

(6) The vent systems (e.g., tubing or piping) for flammable storage cabinets shall be fire-rated in accordance with NFPA 30 4.3.4 unless other methods of protecting the fire integrity of the vent openings are provided. Means of achieving this protection may include thermally actuated dampers and/or sufficiently insulated vent tubing.

h. Ventilation of Gas Cylinders. Refer to Chapter 4, paragraph 12.e, of this Manual.

13. Internal Combustion Engine

Refer to Section 15 of the *AE&P Guidelines* for technical requirements and specifications.

14. Elevators

Refer to Section 14 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

Chapter 6 - Electrical Systems

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Chapter 6 - Electrical Systems

1. Purpose

This chapter provides, or directs the reader to, the safety requirements for the installation of electrical systems, including fire alarm systems, exit and emergency lighting, emergency shutdown of ventilation and cooling systems, and emergency power for critical equipment. Refer to Section 16 of the *Architecture, Engineering, and Planning Guidelines* (the *"AE&P Guidelines"*) for technical requirements and specifications concerning electrical systems.

2. References

Unless otherwise specified in this Manual or approved by the Architecture, Engineering and Real Estate Branch (AEREB) and the Safety, Health and Environmental Management Division (SHEMD), all electrical installations shall conform to the applicable requirements of the current national association standards referenced in Section 15 of the *AE&P Guidelines.*

3. Electrical Installation

Refer to Section 16 of the *AE&P Guidelines* for additional criteria, technical requirements, and specifications.

a. Electrical Outlets. Sufficient electrical circuits and receptacles shall be provided to eliminate the need for extension cords, which can become trip hazards. Dedicated outlets and receptacles for permanently installed equipment shall also be provided.

b. Convenience Outlets. A minimum of three duplex convenience outlets per work station shall be provided.

4. Plenums, Ducts, and Other Air-Handling Spaces

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

5. Transformers

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

6. Outside Substations and Transformer Installations

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

7. Distribution Systems

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

8. Fire Safety Requirements for Lighting Fixtures

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

9. Locations for the Storage, Handling, and Transferring of Flammable Liquids, Gases, Vapors, and Combustible Dusts

Rooms, spaces, and areas where the storage, handling, or transfer of flammable liquids, gases or vapors, combustible dusts, or ignitable fibers or flyings occurs shall meet the requirements established in the National Fire Protection Association (NFPA) 70 (also known as the National Electrical Code, or NEC), Article 500. The specific classifications are:

Class I: Flammable gases, vapors, and liquids
Class II: Combustible dust
Class III: Ignitable fibers or flyings.

Of these classifications, Class I is the most frequently encountered in EPA facilities. Class I locations are further broken down into Division 1 and Division 2. Class I, Division 1 locations are typically locations where ignitable concentrations of gases or vapors can exist under normal conditions. These locations would include areas used for dispensing or transferring volatile liquids from one container to another or spray operations that use volatile liquids. Class I, Division 2 locations are locations where, under normal conditions, ignitable concentrations of gases or vapors would not exist, either because containers are sealed or because mechanical ventilation is provided. It should be noted that Class I, Division 2 locations could develop ignitable concentrations under unusual conditions, such as failure of the ventilation system or accidental rupture of storage containers. Such unusual conditions do not constitute a valid basis for considering a Class I, Division 2 location as a Class I, Division 1 location.

10. Exit Lighting and Markings

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

11. Fire Alarm Systems

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

12. Emergency Lighting

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

13. Emergency Power

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

14. Ground-Fault Protection of Equipment

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

15. Ground-Fault Circuit Interrupter (GFCI) Protection for Personnel

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

16. Uninterruptible Power Supply

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

17. Electrical Safety Requirements

Special attention should be given to the general electrical safety requirements listed below. These requirements have been extracted from the relevant sections of 29 CFR Part 1910 and the NEC. The design of EPA facilities must include these requirements.

a. Disconnecting means, such as switches and circuit breakers, shall be labeled legibly as to their purpose.

b. Electrical installations shall not be accessible to unqualified persons. Installations should thus be secured behind a lockable door, contained in an electrical vault, or safeguarded by other approved means. Specifically, all live parts of electrical systems with 50 volts (V) or more must be guarded by approved cabinets, a vault, or a locked door.

c. Grounding conductors must be distinguishable from all other conductors.

d. Electrical distribution closets and rooms must be provided with adequate illumination.

e. All electrical circuits must be provided with overcurrent protection.

f. Only electrical equipment that bears the manufacturer's name and trademark shall be used in EPA facilities.

g. Electrical working space, closets, and equipment rooms shall not be used for storage.

h. Circuit breakers must be clearly marked to indicate open or closed position.

i. Overcurrent devices shall be readily accessible to building maintenance personnel.

j. Electrical equipment (more than 15V) that services water fountains must be provided with GFCIs.

k. Emergency shutoff switches shall be provided at all exits from the electronic equipment area. These switches will allow for the disconnection of all power to the electronic equipment and air-conditioning systems. The same shutoff switch shall be connected to a sprinkler waterflow device so that the power to the computer room, including the air handlers, will be shut off automatically when the sprinkler system operates. The waterflow device used to disconnect power to the equipment shall be equipped with a supervised bypass switch so that maintenance testing can be conducted without disconnecting power to the computer room equipment.

18. Lightning Protection Systems

Refer to Section 16 of the *AE&P Guidelines* for criteria, technical requirements, and specifications.

19. Communications Equipment

When equipment is essential to the continuity of operation of the building or is otherwise critical, the communications room shall be protected by fire-rated enclosures conforming to the requirements for partitions contained in Chapter 4, paragraph 5, of this Manual. Communications installations shall meet the requirements of the NEC, Article 800-52. The EPA Structural Wiring/Telecommunications Guidelines of April 1997 should be used as a guidance document for all new installations.

20. Lighting

Illumination in EPA facilities shall conform as closely as practical to the recommendations of the Illuminating Engineering Society of North America, as described in its handbook *Recommended Practices*, as well as to the guidelines established in 41 CFR Part 101-20; GSA's PBS-PQ100.1, Table 6-2; and other consensus documents. Some recommended lighting levels are as follows:

a. 50 to 100 footcandles in laboratory spaces, measured at bench level.

b. 50 footcandles at workstations in general office areas, measured at a height of 30 inches above floor level.

c. 30 footcandles in other work areas (e.g., warehouses and storage rooms) measured at 30 inches above floor level.

d. 20 footcandles in corridors and 25 footcandles [in] stairways, measured at the walking surface.

Where unshielded broad-spectrum or ultraviolet lighting is installed, accommodations must be made to protect photosensitive employees, operations, and equipment. Ultraviolet lights installed for scientific operations shall be evaluated for safety on a case-by-case basis, and shielding or interlocks shall be provided where appropriate.

Chapter 7 - Environmental Management

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Chapter 7 - Environmental Management

1. Purpose

The purpose of this chapter is to establish environmental specifications to be addressed by managers of facilities and related building systems. Specific areas covered by this chapter include facility-related environmental requirements for air pollution control, water pollution control, hazardous waste and toxic substances management, fuel and hazardous substance storage, pesticide usage, and radioactive materials management. Considerations are also presented for integrating design for environment factors into the facility planning process. The EPA *Safety, Health, and Environmental Management Guidelines* can also be consulted for guidance on operational issues related to environmental management.

2. References

Interspersed throughout this chapter are many references to documents, parts of the Code of Federal Regulations, and other resources that may enhance understanding of a particular topical area or provide further guidance. A complete list of the references cited in this Manual is included in Appendix A.

3. Air Pollution Control

a. Design Considerations for New Emissions Sources. In accordance with prevailing federal and/or state requirements, potential sources of air pollution emissions at EPA facilities shall be identified in a documented inventory as an integral part of facility construction or modification planning.

(1) Air pollution control inventories shall be established prior to facility and equipment construction, considering the following point source emissions, at a minimum:

(a) Fossil fuel–fired boilers used to produce hot water or steam for heating purposes.

(b) Internal combustion engines (e.g., emergency power generators).

(c) Solid/biological waste incinerators.

(d) Paint/mechanical shop exhausts.

(e) Laboratory fume hoods.

(f) Cooling towers.

(g) Aboveground storage tanks (ASTs) and gasoline-dispensing operations.

The air emission inventories shall include a list of point sources such as those described above, as well as information on types of fuels (for combustion equipment) and anticipated types of pollutants, as information is available. In addition, inventories maintained by existing facilities must be updated to reflect the installation of new air emissions sources.

The maximum operating design capacity (e.g., British thermal units [Btu]/hour heat input capacity, horsepower rating), fuel type, and estimated annual fuel consumption shall be determined prior to installation (or modification) of air emissions sources. Once this information has been determined, federal, state, and local air pollution control regulations will be consulted to determine which preconstruction and operational permitting obligations must be fulfilled as a part of formal equipment commissioning. Appendix C of this Manual provides a list of state environmental agency contacts, including air pollution control organizations.

(2) The following emissions sources shall be designed and equipped during installation (or modification) in accordance with New Source Performance Standards (NSPS) and other applicable technology considerations, as described below:

(a) Fossil fuel–fired boilers with a heat input capacity greater than 100 million Btu/hour (29 megawatts): 40 CFR Part 60, Subpart Db.

(b) Fossil fuel–fired boilers with a heat input capacity of 10 million to 100 million Btu/hour (2.9–29 megawatts); 40 CFR Part 60, Subpart Dc. (Two facilities with emissions sources in this category are the Andrew W. Breidenbach Environmental Research Center in Cincinnati with two boilers having 54 million Btu/hour heat input capacity each, and the National Vehicle and Fuel Emission Laboratory in Ann Arbor with three boilers having 29 million Btu/hour heat input capacity each.)

(c) Volatile-organic-liquid-containing storage facilities with a volume of 40 cubic meters (approximately 10,600 gallons) or greater: 40 CFR Part 60, Subpart Kb.

(d) Sources of volatile organic compounds (VOCs) (e.g., laboratory fume hoods, painting operations, aboveground storage tanks) and nitrogen oxides (e.g., boilers) in ozone nonattainment areas are defined as “major sources” based on their emission levels and the attainment classification of their air quality control region. Current nonattainment areas can be determined by contacting the Air Compliance Branch in the Air Toxics

Division of the EPA Regional Office for the region where the source is located.

Major sources of VOCs and nitrogen oxides are classified by their potential to emit these ozone-forming compounds. "Potential to emit" is defined as the maximum capacity of a stationary source to emit a pollutant under its physical or operational design. Table 7-1 identifies the threshold limits for emissions and the corresponding nonattainment area classifications for VOCs and nitrogen oxides.

Table 7-1. Ozone Nonattainment Area Classifications

Classification	Emission Thresholds for Major Sources (tons per year)
Marginal	100
Moderate	100
Serious	50
Severe	25
Extreme	10

Facilities with sources identified as major under the above criteria must be designed to reduce emissions by application of reasonably available control technology (RACT) or best available control technology (BACT) as specified by state regulations and applicable federal Control Technical Guidelines adopted by state programs. The EPA Air Pollution Control Technology Center in Research Triangle Park, North Carolina, is a clearinghouse for information on approved control technologies for different types of air emissions sources. The technology center can be reached through its hotline by calling (919) 551-0800.

b. Requirements for Emissions Regulated by the National Emission Standards for Hazardous Air Pollutants (NESHAPs). Special requirements apply to:

(1) Asbestos. Activities involving the demolition or removal of asbestos-containing materials must be performed in accordance with the design and operational specifications of 40 CFR Part 61, Subpart M, and 29 CFR §1926.58 as well as any more stringent state and local regulations. Requirements for operation and maintenance of facilities with asbestos-containing materials are specified in the *EPA Policy and Program for the Management of Asbestos-Containing Building Materials at EPA Facilities* and accompanying standard operating practices and standard methods.

(2) Hexavalent chromium (cooling towers). Facilities shall not be designed or modified to include the use of hexavalent chromium–containing biocides or scale inhibitors in cooling and circulation towers.

(3) Other hazardous air pollutants (HAPs). Facilities that emit hazardous air pollutants (HAPs) listed in Section 112 of the Clean Air Act in quantities that exceed 10 tons per year for a single HAP or 25 tons per year of two or more HAPs may be subject to special permit and emission control requirements. The construction or modification of facilities that have the potential to emit threshold quantities of these HAPs should be designed in accordance with 40 CFR Parts 61 and 63. More stringent state toxic-air-pollution control regulations shall also be reviewed for technology considerations impacting facility construction and modification planning.

c. Halon Fire-Extinguishing Systems. All EPA facility fire protection systems containing halon-1301, halon-1202, or halon-1211 have been inventoried and are either already removed or planned for removal. These systems are to be replaced with systems containing alternatives approved under the Significant New Alternatives Policy (SNAP) codified in 40 CFR Part 82, Subpart G. To obtain the most current list of alternatives approved under SNAP, call the Stratospheric Ozone Protection Hotline at 1-800-296-1996 or access the associated Internet site at http://www.epa.gov/docs/ozone/title6/snap/snap.html. New halon fire-extinguishing systems should not be installed in EPA facilities. This policy applies to both fixed systems containing halon-1301 and portable extinguishers containing halon-1211. Existing systems requiring recharge should contact the Halon Recycling Corporation at 1-800-258-1283 for information about recycled halon available from distributors. For information on halon system decommissioning, refer to paragraph 2.d.(4) of this chapter. Also refer to Section 15 of the *Architecture, Engineering, and Planning Guidelines* ("the *AE&P Guidelines*") for additional information.

d. Chlorofluorocarbon (CFC)-Containing Systems. New heating, ventilation, and air-conditioning (HVAC) systems that contain CFC refrigerants are not to be installed in EPA facilities because of the production phaseout of ozone-depleting substances covered under Title VI of the Clean Air Act, as amended in 1990. New systems must use refrigerants acceptable under SNAP in 40 CFR Part 82, Subpart G, as described below. SNAP regulations prohibit users from replacing CFCs with chemicals that pose an even greater risk to human health and the environment. As of the publication of this Manual, existing HVAC systems that contain CFC refrigerants shall be maintained in accordance with the practices described below.

(1) New systems. All new HVAC systems shall use refrigerants identified by EPA as safe and acceptable under 40 CFR Part 82, Subpart G. Table 7-2 provides examples of acceptable and unacceptable replacement technologies for CFC chiller systems as of the publication of this Manual. This table does not

contain an exhaustive list and can be amended by petitioning the EPA for evaluation of new or unlisted alternatives.

Table 7-2. Examples of Acceptable Replacement HVAC Systems

System Type	Existing System	Acceptable Substitute	Unacceptable Substitute
Centrifugal	R11	• Hydrochlorofluorocarbon (HCFC)-123 • HCFC-22 • Hydrofluorocarbon (HFC)-134a • HFC-227a • Ammonia Vapor Compression • Evaporative Cooling • Desiccant Cooling • Ammonia/Water Absorption • Water/Lithium Bromide Absorption	• HCFC-22/HFC-142b/CFC-12 • Hydrocarbon A
Centrifugal	R12	• HFC-123 • HCFC-22 • HFC-134a • Ammonia Vapor Compression • Evaporative Cooling • Desiccant Cooling • Ammonia/Water Absorption • Water/Lithium Bromide Absorption	
Reciprocating	R12	• HFC-134a • R-401A • R-401B • Evaporative Cooling • Desiccant Cooling	• HCFC-22/HFC-142b/CFC-12 • Hydrocarbon A
The information in this chart should be periodically updated by calling the EPA Stratospheric Ozone Protection Hotline at 1-800-296-1996 or by accessing the Internet site at http://www.epa.gov/docs/ozone/title6/snap/snap.html.			

Each new system must comply with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standard 15 and guideline 3 to ensure that the equipment has the proper safety features. These safety features may include sensitive detectors, alert systems, and information on required ventilation systems.

(2) Retrofit of old systems. EPA's Architecture, Engineering and Real Estate Branch (AEREB) encourages that old systems be replaced, not retrofitted. If retrofitting is the option selected, however, existing systems can be retrofitted with the refrigerants listed in Table 7-3. EPA facilities shall follow the retrofit instructions provided by the refrigerant manufacturer and the HVAC equipment manufacturer.

Table 7-3. Existing CFC System Retrofit Options

System Type	Existing System	Acceptable Retrofit	Unacceptable Retrofit
Centrifugal	R11	HCFC-123	HCFC-141b
Centrifugal	R12	HFC-134a R-406A	HCFC-22/HFC-142b/CFC-12
Reciprocating	R12	HFC-134a R-401A R-401B	HCFC-22/HFC-142b/CFC-12
The information in this chart should be periodically updated by calling the EPA Stratospheric Ozone Protection Hotline at 1-800-296-1996 or by accessing the Internet site at http://www.epa.gov/docs/ozone/title6/snap/snap.html.			

(3) Maintenance and operation of existing equipment. No person maintaining, repairing, or disposing of appliances may knowingly vent, or otherwise release into the atmosphere, a Class I or II substance (see Appendix D for the list of EPA-regulated ozone-depleting substances) used as a refrigerant in such equipment unless this venting or releasing is associated with a good faith attempt to recover or recycle the refrigerant (40 CFR §82.154). In addition, all persons opening appliances, except for persons opening motor vehicle air conditioners (MVAC) for maintenance, service, or repair, must evacuate the refrigerant to a system receiver or a recovery or recycling machine certified pursuant to 40 CFR §82.158. Table 7-4 lists the required evacuation levels.

Table 7-4. CFC Equipment Servicing

Type of Appliance	Required Evacuation Levels (in inches of Hg vacuum [relative to standard atmospheric pressure of 29.9 inches Hg])	
	Using recovery or recycling equipment manufactured or imported before 11/15/93	Using recovery or recycling equipment manufactured or imported on or after 11/15/93
HCFC-22 appliances, or isolated component of such appliances, normally containing less than 200 pounds of refrigerant	0	0
HCFC-22 appliances, or isolated component of such appliances, normally containing 200 pounds or more of refrigerant	4	10
Very-high-pressure appliances	0	0
Other high-pressure appliances, or isolated component of such appliances, normally containing less than 200 pounds of refrigerant	4	10
Other high-pressure appliances, or isolated component of such appliances, normally containing 200 pounds or more of refrigerant	4	15
Low-pressure appliances	25	25

All persons who maintain, service, or repair appliances, except MVACs, and all persons who dispose of appliances, except for small appliances, room air conditioners, and MVACs, must be certified by an approved technician certification program under 40 CFR §82.161. Facilities shall keep servicing records documenting the date and type of service and the quantities of refrigerant added. Facilities also shall keep copies of technician certifications at the facility for 3 years.

Equipment used in the recovery or recycling of refrigerants must meet the standards under 40 CFR §82.158 and be capable of achieving the level of evacuation in Tables 7-5 and 7-6. Systems equipped with a noncondensables purge device must not release more than 3 percent of the quantity of refrigerant being recycled through noncondensables purging. The required levels of vacuum for equipment manufactured on or after November 15, 1993, are listed in Table 7-5.

Table 7-5. Required Levels of Vacuum for Equipment Manufactured On or After November 15, 1993

Type of Appliance with which Recovery or Recycling Machine Is Intended To Be Used	Inches of Hg Vacuum
HCFC-22 appliances, or isolated component of such appliances, normally containing less than 200 pounds of refrigerant	0
HCFC-22 appliances, or isolated component of such appliances, normally containing 200 pounds or more of refrigerant	10
Very high-pressure appliances	0
Other high-pressure appliances, or isolated component of such appliances, normally containing less than 200 pounds of refrigerant	10
Other high-pressure appliances, or isolated component of such appliances, normally containing 200 pounds or more of refrigerant	15
Low-pressure appliances	25

The required levels of vacuum for equipment manufactured before November 15, 1993, are listed in Table 7-6.

Table 7-6. Required Levels of Vacuum for Equipment Manufactured Before November 15, 1993

Type of Appliance with which Recovery or Recycling Machine Is Intended To Be Used	Inches of Hg Vacuum
HCFC-22 appliances, or isolated component of such appliances, normally containing less than 200 pounds of refrigerant	0
HCFC-22 appliances, or isolated component of such appliances, normally containing 200 pounds or more of refrigerant	4
Very-high-pressure appliances	0
Other high-pressure appliances, or isolated component of such appliances, normally containing less than 200 pounds of refrigerant	4
Other high-pressure appliances, or isolated component of such appliances, normally containing 200 pounds or more of refrigerant	4
Low-pressure appliances	25

Any organization servicing equipment containing Class I or Class II refrigerants must certify to EPA that its recovery and recycling equipment is certified to the above standards. Certifications shall be sent to the appropriate EPA Regional Office listed in 40 CFR §82.162 based on the location of the facility. Reclaimed refrigerants for use in EPA facilities must fulfill the purity standards set forth in American Refrigeration Institute (ARI) Standard 700-1993.

If commercial and industrial refrigeration equipment with a refrigerant charge of 50 pounds or more is leaking at a rate exceeding 35 percent of the total annual charge, it must be repaired. Facilities can be assessed with fines of up to $25,000 per day per violation.

For maintenance and servicing of MVACs, refrigerant recovery and recycling equipment must be used and must meet the standards in Appendix A of this Manual pursuant to 40 CFR Part 82, Subpart B, Recommended Service Procedure for the Containment of R-12, Extraction and Recycle Equipment for Mobile Automotive Air-Conditioning Systems, and Standard of Purity for Use in Mobile Air Conditioning Systems, SAE J1990.

(4) System decommissioning. Persons disposing of appliances except for small appliances, MVACs, and MVAC-like appliances, must evacuate to the levels in Table 7-3.

Several organizations will accept or buy surplus halons and CFCs from EPA facilities. These organizations include the government-sponsored Halon Recycling Corporation at 1-800-258-1283 or (703) 524-6636, and the Defense Logistics Agency in Richmond, Virginia, at (804) 279-4525. The Defense Logistics Agency repository will accept surplus CFC-11, CFC-12, CFC-14, and halon-1301. Recovered halon and CFCs may be shipped in any size cylinder provided that the cylinder is tagged and labeled with the shipper's name, address, and telephone number; the type and quantity of ozone-depleting substance shipped; and the appropriate U.S. Department of Transportation (DOT) warning labels. The repository will also accept fire extinguishers and halon spheres. Fire suppression systems with electrical charges must be deactivated, and safety caps must be used to cover exposed activation mechanisms, prior to shipment. For additional information, write to:

Halon Recycling Manager
Defense Depot Richmond Virginia
SWO400
Cylinder Operations
800 Jefferson Davis Highway
Richmond, VA 23297-5000

e. Indoor Air Quality. In recognition of the need to provide practical indoor-air-quality design guidance, the following design considerations are presented to reflect industry-accepted practices in the fields of building science and indoor air quality.

(1) Location of building. The location of a building can affect the quality of air being introduced into the building regardless of the design and operation of the HVAC system. Some sources of air pollution outside the building are pollen, dust, fungal spores, industrial pollutants, general vehicle exhaust, contaminants from previous uses of site or current uses of adjoining site (e.g., landfill, tank farm), and radon. The siting of the building should take into consideration outside sources of contaminants as well as the siting criteria for laboratories cited in Section 2 of the *AE&P Guidelines*.

(2) Building design. The original design and the intended use of the building can affect the quality of the air. HVAC systems shall be evaluated to determine whether the building HVAC system is functioning as designed and meets the requirements established in ASHRAE 62, and American National Standards Institute (ANSI)/ASHRAE 55, and the fume hood information in Chapter 5 of this Manual and in Section 15 of the *AE&P Guidelines*. HVAC systems shall also be retested against the above-stated criteria if the building has been significantly renovated or if HVAC system equipment has been replaced.

(3) Design of HVAC system. The HVAC system shall be designed to maintain temperature and humidity within acceptable ranges (as outlined in ANSI/ ASHRAE 55-1981), to supply sufficient amounts of conditioned outside fresh air (20 cubic feet per minute [cfm] per person), to distribute appropriate volumes of air and air movement (as outlined in ANSI/ASHRAE 55-1981), and to facilitate the cleaning and maintenance of the HVAC system components as discussed in Chapter 5 of this Manual and in Section 15 of the *AE&P Guidelines* and as required by state and local building codes. The location of outdoor air intakes should be away from contaminant sources (e.g., plumbing vents, cooling towers, local exhaust stacks, loading docks). Where air intakes and pollution sources are in close proximity, modeling shall be used to confirm adequate separation to prevent entrainment of contamination into the facility. Additional ventilation design parameters (e.g., stack height, exhaust gas velocity, exhaust and intake placement) can be found in the American Conference of Government Industrial Hygienists (ACGIH) Ventilation Manual.

In mixed-use buildings the HVAC system should maintain appropriate pressure relationships to isolate and control odors and contaminants (e.g., from laboratories, attached parking garages, print shops, hazardous material storage areas, smoking lounges, kitchens).

(4) Interior furnishings, materials, and equipment. Interior furnishings, materials, and equipment (e.g., carpet, draperies, furniture, paint, office equipment) shall be, where practical, of the low-VOC-emitting (e.g., formaldehyde) or low-ozone-depleting type. Where purchase of such furnishings, materials, or equipment is impracticable, sufficient time shall be provided to allow initial off-gassing of VOCs prior to occupancy, as discussed in Section 15 of the *AE&P Guidelines*. Other related requirements are found in Sections 9, 10, 11, and 12 of the *AE&P Guidelines*. Interior furnishings, materials, and equipment shall not obstruct the flow and distribution of supplied air within occupied spaces.

(5) Local exhaust systems. Local exhaust systems shall be provided for sources of airborne contaminants when general HVAC dilution ventilation is not sufficient to maintain odors and contaminants at safe levels (e.g., chemicals and odors from janitorial closets, smoking lounges, bathrooms).

For additional information on indoor air quality refer to EPA's *Building Air Quality: A Guide for Building Owners and Facility Managers*, December 1991.

4. Water Pollution Control

a. Design Considerations for National Pollutant Discharge Elimination System (NPDES) Discharge Requirements. Potential sources of NPDES-regulated discharges to surface water shall be identified in a documented inventory of point and nonpoint discharge sources. NPDES discharge source inventories shall be an integral part of facility construction or modification planning and shall include:

(1) Process effluent discharges
(2) Noncontact cooling-water discharges
(3) Stormwater discharges.

b. Determination of NPDES Permitting Obligations. The anticipated operating conditions of discharge sources (e.g., flow rate and concentrations of discharged constituents) shall be evaluated to determine applicable federal and state NPDES permit requirements. Applicable NPDES permitting conditions shall be reflected in design specifications, including representative flow monitoring, sampling, special pretreatment systems, and drainage.

c. Identification of NPDES Special Design and Control Technologies. Special engineering design and control technologies shall be considered and developed in accordance with applicable NPDES permit conditions and the BAT effluent guidelines of 40 CFR Parts 406–471.

d. Determination of Septic and Aquifer Discharge Requirements. State and local requirements shall be identified for facilities that will discharge to septic systems or aquifers. Compliance with these provisions will be achieved by incorporating the appropriate design and engineering controls. AEREB shall be contacted for approval of any non-stormwater discharges into septic systems or aquifers.

e. Determination of Publicly Owned Treatment Works (POTW) Pretreatment Standards and Effluent Monitoring Requirements. For facilities discharging effluent to a POTW, applicable federal (see 40 CFR §403.5(b)) and state (see Appendix C for state water pollution control contacts) pretreatment standards, local sewer use ordinance, permitting, and effluent monitoring requirements shall be determined. If applicable, permitting and pretreatment obligations for significant industrial users must be achieved in design and installation. The monitoring and sampling requirements shall be determined for all discharge points and shall include, at a minimum, flow rate, pH measurement, and representative influent/effluent sample collection. Additionally, the facility shall have a plumbing design configuration to facilitate mapping of effluent discharge pathways, identification of representative sampling points, and future plumbing system modifications.

f. Elementary Neutralization Systems. Systems shall be provided to neutralize and monitor wastewater discharges for facilities with corrosive effluents to ensure EPA facility conformance with the Clean Water Act pretreatment standards in 40 CFR §403.5(b)(2) and standards imposed by local POTWs. The system shall include flow-rate measurement, pH sensors, pH adjustment capabilities, and engineering features to enable the collection of representative effluent samples. Guidance on collecting representative wastewater samples to determine effluent quality can be obtained from the EPA publication, *Industrial User Inspection and Sampling Manual for POTWs*, EPA 831-B-94-001, April 1994. The system engineering controls shall provide the capability to identify and mitigate unacceptable discharges; such controls include pH excursion alarms and automatic flow cutoff devices. System designs shall provide for the routine operation and maintenance of key components such as agitators, pumps, and pH probes.

g. Drinking Water. Facilities shall adhere to the requirements listed below.

(1) Identification of potable water supply. Facility construction planning should include a determination of the source of potable water supplies. Facilities that obtain drinking water from municipal sources have limited responsibilities for monitoring drinking water, except initial construction and leasing monitoring. Where drinking water is derived from on-site wells and is provided to an average of 25 individuals daily for at least 60 days out of the year, more extensive monitoring is required for the physical, chemical, biological, and radiological parameters identified in 40 CFR Parts 141 and 143.

(2) Applicable monitoring requirements. The quality of potable water in all newly leased or constructed facilities shall be tested (optimally, a sample should be drawn from the main supply line to the facility) to ensure conformance with the following levels: aluminum (0.2 milligrams per liter [mg/L]), chloride (250 mg/L), color (15 color units), copper (1.3 mg/L), iron (0.3 mg/L), lead (0.015 mg/L), manganese (0.05 mg/L), pH (6.5-8.5), silver (0.1 mg/L), sulfate (250 mg/L), total dissolved solids (500 mg/L), and zinc (5 mg/L).

In newly acquired facilities or newly plumbed systems, lead (action level of 15 micrograms per liter [μg/L]) and copper (action level of 1.3 mg/L) monitoring shall also be performed to ensure conformance with the action levels specified above in response to major facility modifications, plumbing system alterations, or the addition of new water supply fixtures (e.g., water coolers). Potable water shall be tested for lead content in accordance with the EPA publication entitled *Lead in School Drinking Water*, EPA 57019-89-001, January 1989. For copper monitoring of potable water, the Office of Water recommends that one 30-second flush sample be taken at an internal tap from which water is typically drawn for consumption.

Facilities that provide potable water to an average of 25 individuals daily for at least 60 days out of the year are defined as public water systems. These are subject to monitoring for physical, chemical, radiological, and biological parameters as specified in 40 CFR Part 141.

(3) Pretreatment considerations. Facilities that obtain drinking water from on-site wells should be designed with sufficient pretreatment capabilities to ensure the safety and aesthetic quality of the water for general consumption. At a minimum, pretreatment systems for water obtained from on-site sources should provide levels of performance that ensure fulfillment of the primary maximum contaminant levels in 40 CFR Part 141, the lead and copper action levels in 40 CFR §141.80, and the secondary maximum contaminant levels in 40 CFR Part 143.

5. Solid and Hazardous Waste

a. Identification of Hazardous Waste Management Activities. Requirements vary depending on the way in which hazardous waste is managed. The majority of EPA facilities operate solely as generators of hazardous waste, subject to quantity or accumulation time limits (see 40 CFR §262.34). EPA offices and administrative buildings may not generate sufficient quantities of hazardous waste to warrant substantive regulation under federal and state hazardous waste laws. Hazardous waste management activities common to EPA facilities include those described below.

(1) Generator container accumulation. Hazardous wastes at EPA facilities are most commonly held in containers, such as glass solvent jugs, plastic jerry cans, and 55-gallon drums.

(2) Generator tank accumulation. Aboveground or underground tanks may be used to hold larger volumes of liquid waste either indoors or outdoors.

(3) Treatment, storage, or disposal. Certain types of treatment, longer term accumulation, and most forms of disposal may alter the regulatory status of the facility. Such a change can involve extensive permitting and facility design considerations.

b. Determination of Applicable Regulatory Requirements. Facilities shall consider federal and state requirements.

(1) Federal. Federal hazardous waste requirements are found in 40 CFR Parts 260 through 279. Parts 262, 264, and 265 are the most relevant to facility design.

(2) More stringent state requirements. State requirements may be more stringent than federal regulations. State agencies and implementing regulations shall be consulted to help identify applicable standards and determine whether requirements exceed federal regulations. Appendix C of this Manual provides a contact list of state hazardous waste management agencies.

c. Facility Design Requirements for Containers. Requirements for managing containers are listed below.

(1) Central hazardous waste accumulation (per 40 CFR Part 264, Subpart I). Sufficient space must be allowed, or a protective barrier installed, so that incompatible wastes (e.g., oxidizers and ignitables) can be separated by a safe distance or means. Container management areas must have sufficient capacity to contain at least 10 percent of the volume of containers or the volume of the largest container to be accumulated, whichever is greater. The base of the containment system must be free of cracks and gaps and be sufficiently impervious to contain leaks or spills until the collected material is detected and removed. If ignitable or reactive wastes are generated, the accumulation facility or area will need to be located at least 50 feet from the facility's property line.

(2) Emergency preparedness equipment. Aisle space in hazardous waste accumulation areas shall be sufficient to allow for container inspection and for the unobstructed movement of personnel and emergency equipment. State regulations may indicate exact distances.

Fire extinguishers and other fire control equipment shall be available at hazardous waste accumulation points. Water must be available in sufficient volume and at sufficient pressure to facilitate fire-fighting operations (for example, sprinklers and hose streams). In addition, other safety equipment such as eyewashes and safety showers shall be provided in accordance with the provisions of Chapter 4, paragraph 16, of this Manual.

Two-way communications, such as radios or telephones, and alarm systems to initiate emergency response shall be immediately available to hazardous waste accumulation areas (see 40 CFR §265.32).

Requirements imposed by more stringent state hazardous waste management regulations shall be reviewed and addressed, as appropriate, to augment these specifications.

(3) Occupational Safety and Health Administration (OSHA)/National Fire Protection Association (NFPA) egress considerations. Central hazardous waste accumulation areas shall be designed in accordance with applicable means-of-egress standards referenced in Chapter 4 of this Manual.

d. Facility Design Requirements for Tanks. The installation of hazardous waste tanks shall provide for sufficient area for visual tank inspection and installation of secondary containment, such as a double-wall or berm. Hazardous waste tanks must be installed in accordance with 40 CFR Part 264, Subpart J. If ignitable or reactive wastes are intended for management within tank systems, a minimum distance of 50 feet from the property boundary shall be maintained.

e. Facility Design Requirements for Other Units. Other types of hazardous waste units may be operated at a facility, but only at facilities with a treatment, storage, or disposal permit. Such units include incinerators, surface impoundments, waste piles, and other devices, called “miscellaneous units,” approved by EPA or the state. Specific subparts are included in 40 CFR Part 264 for these units and shall be consulted if such units are considered.

f. Green Lights Projects. When planning or performing Green Lights upgrades and fluorescent light maintenance projects, special considerations are required for the management of the spent mercury-containing light bulbs and potentially PCB-contaminated ballasts. Mercury-containing fluorescent light bulbs are considered hazardous waste. Disposal and management practices for the waste shall be consistent with the joint AEREB and Safety, Health and Environmental Management Division (SHEMD) memorandum (June 15, 1995) on waste fluorescent and high-intensity discharge bulb management. (See Memorandum on Lighting Fixture Disposal Guidance and Strategy in Appendix F of this Manual.)

g. Solvent Recovery/Recycling. Solvent recovery stills and similar operations must be operated in ventilated enclosures or in distillation (Knee-high or Low-boy) hoods. The enclosures should be of sufficient size and configuration to accommodate the still, contaminated-solvent container, and receiving receptacles and to allow sashes or doors to be completely closed during operation. Additionally, the electrical systems inside the enclosure as well as ventilation equipment (e.g., fan motor) must meet requirements in Chapter 5 of NFPA 70 (National Electrical Code). Care should be exercised in handling bottles containing hazardous materials/wastes to prevent damage to the receptacles (typically glass bottles) resulting in a spill. Additional information can be found in Chapter 5 of this Manual concerning ventilation of these types of enclosures.

6. Petroleum and Hazardous Substance Storage

a. Spill Prevention and Control Planning (40 CFR Part 112). EPA facilities shall determine the potential spill risks associated with storing petroleum and hazardous substances and shall perform an assessment of the magnitude of these risks to facilitate effective prevention and control planning.

(1) Determination of potential spill risks. Potential spill risks are presented by petroleum and hazardous material storage vessels of all kinds, including aboveground, underground, and internal storage tanks; container and drum storage areas; flow systems (valves and controls); receiving and shipping terminals; waste treatment and disposal areas; and large mineral oil transformers. An accurate inventory of these spill risks shall be documented, including the tank area, size, volume, storage capacity, contents, and function. Information for other types of spills associated with processes or operations involving the handling of hazardous substances shall be documented. A facility layout shall be prepared identifying the spill risk areas and probable dispersion pathways, topography, facility boundaries, and all buildings and structures. The preventive systems, sources of water for fire fighting, and service and emergency facilities relative to the spill risk areas shall be clearly represented in the layout. Major community receptors related to the spill risk area shall be represented on the layout or on a separate layout.

(2) Risk assessment. Spill prevention and control planning requires performance of a risk assessment of the type of material storage, the quantity and type of material, and the incompatible surrounding storage conditions. There should be an evaluation of whether multiple or single releases could occur and what impact the release would have given the potential exposure pathways, direction and rate of spill flow, and the sensitive environmental areas and natural resources surrounding the storage area and facility. Sensitive environmental areas may include waterways, wetlands, recreational and park areas, forests, and wildlife sanctuaries. Natural resources, such as fish and wildlife, forest,

waterways, agriculture, and groundwater critical to the local community, shall be assessed and the required measures taken to mitigate risk.

b. Aboveground Storage Tanks

(1) Assessment of aboveground storage tank requirements. Before the AST specifications and design are determined, several AST requirements shall be assessed and considered, including the material type, volume, throughput requirements, surrounding conditions, and nature of AST activity. Each of these is discussed below.

(a) Type of material. The type of material and the composition of the substance requiring storage must be assessed. The material may be petroleum, oil, hazardous, nonhazardous, or acutely hazardous. The compatible and noncompatible tank materials for this substance shall be determined.

(b) Volume and throughput requirements. The maximum storage capacity and the rate of material usage must be evaluated. The maximum period of time the material may be needed and the rate of material usage during emergency situations shall also be known.

(c) Surrounding conditions. The surrounding conditions of the tank and associated piping shall be determined, including maximum and minimum operating and exposure temperatures; soil type and background levels of contamination relative to the material to be stored; proximity to navigable waters, adjacent property, and buildings; and location of floodplain, utility lines, and service points. If an AST system is to be upgraded, the age, current as-built design specifications, current tank conditions, and contents shall be determined.

(d) Nature of AST activity. Whether the AST under consideration is a replacement tank, an upgrade project, or a new installation must be determined for the design and performance criteria. For logistical consideration of installation sequence and location, it should be established whether the AST is replacing an existing underground storage tank (UST) or AST.

(2) Applicable AST design standards. All tanks and piping shall be designed according to the state and local requirements, 40 CFR Part 112, NFPA 30 (Section 2-3), 29 CFR Part 1910, and the American Petroleum Institute standards. All states have adopted fire codes that regulate the aboveground storage of petroleum. Many states have adopted technical standards and permitting or registration requirements for ASTs. Some states have construction standards or release prevention requirements that apply to various

categories of tanks. Most common are secondary containment standards such as dike construction, impervious lining, and volume capacity requirements. Other requirements include release detection, corrosion protection, overfill protection, piping and valve standards, as well as impermeable barriers or double bottoms for new ASTs. Section 2-3 of NFPA 30 includes the following requirements for ASTs exceeding a 660-gallon capacity:

(a) Location and spacing of ASTs shall be in accordance with NFPA 30.

(b) Liquefied propane gas (LPG) containers shall be separated from flammable or combustible-liquid storage tanks by 20 feet.

(c) Volume of diked area shall not be less than the capacity of the largest tank within the diked area and should meet other NFPA 30 requirements.

(d) Tanks taken out of service or abandoned shall be emptied of liquid, rendered vapor-free, and safeguarded against trespassing.

(e) When vent pipe outlets for tanks storing Class I liquids are adjacent to buildings or public ways, vents should discharge 12 feet above ground level. In addition, consideration must be given to placement of vent pipe outlets relative to building air intakes.

(3) Conformance with spill prevention control and countermeasure plan (SPCC) requirements. The following SPCC requirements are applicable to aboveground storage capacity greater than 660 gallons of oil in any single aboveground container or 1,320 gallons of aggregate oil capacity, regardless of container size.

(a) Secondary containment. The appropriate secondary containment or diversionary structures to prevent discharged petroleum products from reaching navigable water course, shall be provided. For onshore facilities these may include, but are not limited to, dikes, berms, and retaining walls; curbing; culverts, gutters, or other drainage systems; weirs, booms, or other barriers; spill diversion ponds; retention ponds; and sorbent materials. (See memorandum from Don Clay on the Use of Alternative Secondary Containment Measures at Facilities Regulated Under the Oil Pollution Prevention Regulation [40 CFR Part 112] in Appendix F of this Manual.)

(b) Drainage systems. Drainage for diked storage areas must be restrained by manual open/close valves. Drainage of undiked areas shall drain into ponds, lagoons, or catchment basins for oil retention. These basins shall be designed to avoid flooding. A diversion system to retain uncontrolled spill shall be used when there is final discharge of all in-plant ditches.

Treatment units for drainage shall be designed for gravity flow or backup pumping systems. Drainage areas shall prevent oil from reaching navigable waters in the event of equipment failure or human error.

(c) Security. Security for tanks should be in accordance with 40 CFR §112.7(e)(9), including, but not limited to, fencing, entrance gates with locks, locking valves and pump controls, capped and marked transfer points, and adequate lighting for visibility at night.

(d) Onshore bulk storage tank systems. These tanks shall be compatible with the material stored and provide secondary containment for the entire contents of the largest tank plus freeboard for precipitation. These tanks shall include drainage and alternative containment, high-liquid-level alarms and pump, communication, and liquid-level sensors and gauges in accordance with 40 CFR §112.7(e)(2). Portable tanks should be positioned to prevent spills from reaching navigable waters and should not be located in areas prone to flooding.

(e) Facility transfer operations. If a pipeline is expected to be out of service for an extended period of time, the terminal connection design of the transfer point shall be capped and/or blank flanged, and marked indicating the origin. Pipe supports shall avoid abrasion and corrosion and allow for expansion and contraction. Aboveground pipelines shall be properly located allowing for regular integrity and leak inspections.

c. Underground Storage Tanks

(1) Assessment of underground storage tank requirements. Prior to determining the UST specifications and design, several UST requirements shall be assessed and considered.

(a) Type of material. The type of material and the composition of the substance requiring storage shall be assessed. Substances stored in USTs may be petroleum, oil, or hazardous substances. Tank compatibility with the substances to be stored shall be determined. Other characteristics of the material to be assessed may include specific gravity, immiscibility in water, and volatility of vapor level detection in soils.

(b) Volume and throughput requirements. The amount of material to be stored at one time and the rate of material usage shall be determined. The maximum length of time the material may be needed and the rate of material usage during emergency situations also shall be determined.

(c) Surrounding conditions. The surrounding conditions of the tank and associated piping shall be addressed, including maximum and minimum

operating and exposure temperatures; soil type and background levels of contamination relative to the material to be stored; groundwater level; proximity to navigable waters, adjacent property, and buildings; and location of floodplain, utility lines, and service points. If a UST system is to be upgraded, the age, as-built design specifications, current tank conditions, and contents will need to be determined.

(d) Nature of UST activity. Whether the UST under consideration is a replacement tank, an upgrade project, or a new installation is critical to determining the design and performance criteria. It shall be clearly understood whether the UST is replacing an existing UST or AST because logistical determinations will have to be made concerning installation sequence and location. Also, if a UST is being replaced, the closure method (i.e., closure in place or by removal [40 CFR Part 280, Subpart G]) should be assessed because this will impact the location of the replacement tank.

(2) Applicable UST design standards. All tanks and piping shall be designed according to state (see Appendix C of this Manual for state UST contacts) and local requirements; 40 CFR Part 280, including referenced national consensus standards (e.g., American Petroleum Institute standards); 40 CFR Part 112; NFPA 30; and 29 CFR Part 1910. Additionally, states may establish regulations that prescribe more stringent UST design standards. Design standards are listed below but do not apply to the following UST systems: hazardous waste tanks regulated under Subtitle C of the Resource Conservation and Recovery Act, septic tanks, UST systems with a capacity of 110 gallons or less, and stormwater or wastewater collection systems. Specific UST system design requirements include:

(a) Corrosion protection. All UST and associated piping must have corrosion protection. The tank material should be fiberglass-reinforced plastic, or steel-fiberglass-reinforced plastic composite. The pipe material should be fiberglass-reinforced plastic. Approved cathodic protection shall be designed in accordance with 40 CFR §280.20(a)(2) and (b)(2).

(b) Spill and overfill control. Spill prevention equipment (e.g., spill catchment basin) is required to prevent the release of product when the transfer hose is detached from the fill pipe. In addition, overfill prevention equipment shall be used to accomplish one or more of the following:

1. Automatically shut off flow into the tank at 95 percent capacity.

2. Alert the transfer operator at 90 percent capacity with a high-level alarm or flow gauge.

3. Restrict flow 30 minutes prior to overfilling.

4. Alert the transfer operator with high-level alarm 1 minute before overfilling.

5. Automatically shut off flow to prevent tank-top fittings from product exposure.

Spill and overfill prevention is not required if the tank transfers or filling is restricted to 25 gallons of product.

(c) Secondary containment. Secondary containment must be provided for new petroleum-hazardous-substance tanks installed at EPA facilities so that the tank and piping design requirements are to contain any released product until the product is detected and removed, thereby preventing the release of regulated substances into the environment. Double-walled tanks should be provided to contain a release from the inner tank and to allow for the detection of the failure of the inner wall.

(d) Release detection. All existing and new UST systems must provide a method or combination of methods that can detect a release from any portion of the tank and associated underground piping. The release detection method must be installed, calibrated, operated, and maintained in accordance with the manufacturer's instructions and should meet the requirements of 40 CFR §280.43 and §280.44. All release detection methods must be capable of detecting the leak rate with a probability of detection (Pd) of 0.95 and a probability of false alarm (Pfa) of 0.05. Tanks with a volume capacity of 550 gallons or less may rely on manual tank gauging for release detection.

By December 22, 1998, all existing hazardous substance UST systems must meet the release detection requirement for new hazardous substance systems in 40 CFR §280.42(b). Release detection for petroleum and existing hazardous substance USTs shall be provided as specified in 40 CFR §280.40 through §280.42.

Release detection for petroleum underground piping must be in accordance with 40 CFR §280.41(b) and the release detection methods requirements of 40 CFR §280.43 and §280.44. Petroleum suction piping must be capable of detecting a 0.2-gallon-per-hour or 150-gallon-per-month leak rate with a 0.95 Pd or 0.05 Pfa. Release detection is not required for suction piping if the following conditions are met:

1. Below-grade piping operates at less than atmospheric pressure.

2. Below-grade piping is sloped so that the contents of the pipe will drain back into the storage tank if suction is released.

3. Only one check valve is included in each suction line.

4. The check valve is located directly below, and as close as practical to, the suction pump.

5. A method is provided that allows compliance with the above conditions to be readily determined.

(e) Location. USTs shall be located in consideration of existing building foundations. All USTs shall be set on firm foundations. Distance or clearance of USTs from buildings should be in accordance with section 2-4 of NFPA 30, including those requirements described below.

1. For areas subject to traffic, the UST should be protected with 3 feet of earth or with 18 inches of earth well tamped and 6 inches of reinforced concrete.

2. For tanks storing Class I liquids, the distance from any part of the tank to the nearest wall of any basement or pit shall not be less than 1 foot, and the distance to any property line that may be built upon, not less than 3 feet.

3. For tanks storing Class II or III liquids, the distance from any part of the tank to the nearest wall of any basement or pit or to the nearest property line shall not be less than 1 foot.

(f) Vent pipes. Vent pipe requirements for USTs should be in accordance with section 2-4.5 of NFPA 30, including those requirements described below.

1. For Class I–liquid tanks, vent pipes shall be located so that the discharge point is outside of buildings, higher than the fill pipe opening, and not less than 12 feet above the adjacent ground level.

2. For tanks containing Class II or III flammable liquid, vent pipes from tanks shall terminate outside of buildings and higher than the fill pipe opening, with outlets above normal snow level. Normal snow level can be calculated by using the method presented in Section 1111.0 of the Building Officials and Code Administrators

International, Inc. (BOCA) National Building Code or another nationally recognized method.

(g) Tank openings. Connections and openings for gauging, vapor recovery, and fill pipes should be designed in accordance with section 2-4.6 of NFPA 30, including, but not limited to, those requirements described below.

1. Connections for all tank openings and manual gauging openings should be liquid tight.

2. Fill and discharge lines shall enter through the top, and fill lines shall be sloped toward the tank. Fill pipes that enter through the top shall terminate within 6 inches of the tank bottom.

3. Class I–liquid tanks having a capacity of greater than 1,000 gallons shall be equipped with a tight fill device for connecting the fill hose to the tank.

4. Valves, openings, and connections for tanks equipped with vapor recovery shall be designed in accordance with section 2-4.6 of NFPA and with any other applicable requirements.

(h) Installation and certification. All tanks and piping must be properly installed and tested in accordance with the manufacturer's instructions. The following installation procedures may be used:

1. American Petroleum Institute Publication 1615, *Installation of Underground Petroleum Storage System*.

2. Petroleum Engineers Institute Publication RP100, *Recommended Practices for Installation of Underground Liquid Storage Systems.*

3. ANSI standard B31.4, Liquid Petroleum Transportation Piping System.

The following testing, inspection, and certification methods per 40 CFR §280.20(d) and (e) should be used to demonstrate the proper installation:

1. The installer shall be certified by the tank and piping manufacturers or by the implementing agency.

2. The installation shall either be inspected and certified by a registered professional engineer with education and experience in

UST system installation or shall be inspected and approved by the implementing agency.

3. The manufacturer's installation instructions (e.g., tank tightness tests, verification of fitting and tank integrity, ventilation of tank position and anchors, validating cathodic protection) have been performed and completed. Additional guidance on UST installation includes the following videos: (1) *Underground Storage Tanks: Rest in Peace* (Publication No. EPA 501-V-92-601), (2) *Doing It Right Video* (Publication No. EPA 510-V-92-801), and (3) *Doing It Right II: Installing Required* (Publication No. 999-Z-99-999). See Appendix A of this Manual for information about obtaining these videos.

(i) Compatibility. The UST system must be made of, or lined with, materials that are compatible with the substance stored in the UST system.

(j) Repairs. UST system repairs must be made in accordance with 40 CFR §280.33 and nationally recognized standards or according to independent laboratory testing requirements. All repaired UST systems must be tightness tested within 30 days of repair completion and in accordance with the EPA tightness testing regulatory requirements presented in 40 CFR §280.43(c) and §280.44(b).

(3) Conformance with SPCC requirements. The following SPCC requirements are applicable to USTs with capacities of greater than 42,000 gallons of oil.

(a) Security. Security for tanks should be in accordance with 40 CFR §112.7(e)(9), including, but not limited to, facility fencing and entrance gates with locks, locking valves and pump controls, and capped and marked transfer points.

(b) Corrosion protection. Corrosion protection should be provided for buried metallic tanks and piping in accordance with 40 CFR §112.7.

(4) Inside tanks. All tanks shall be designed and maintained in accordance with 29 CFR Part 1910 and NFPA 30 where applicable. Requirements such as separation, location, and ventilation are discussed in more detail in Chapter 4 of this Manual.

Tanks shall not be permitted inside buildings unless the storage of liquids in outside underground or aboveground tanks is not practical because of government regulations, temperature considerations, or production considerations.

d. PCB Equipment Considerations

(1) Electrical equipment. EPA facilities shall not install or use PCB-containing transformers, capacitors, switches, or other types of electrical equipment. Dielectric fluid–containing equipment, including transformers and capacitors manufactured before 1978, must be evaluated to determine PCB content. Equipment found to contain PCBs should be prioritized for removal.

(2) Fluorescent light ballasts. Light ballasts used within fluorescent light assemblies may contain PCBs if manufactured before 1978. Such equipment must be reviewed for PCB content upon removal for routine maintenance or as part of formal energy conservation upgrades (e.g., Green Lights upgrade projects). PCB concentration information can generally be obtained by contacting the ballast manufacturer and providing the equipment lot and serial number. Concurrently, manufacturers of fluorescent lights may also be contacted to determine whether the mercury content possibly triggers hazardous waste regulatory requirements. Ballasts found to contain PCBs shall be managed in accordance with the joint AEREB/SHEMD memorandum (June 15, 1995) on managing light-fixture wastes, with preference given to use of PCB ballast recycling and recovery facilities. (See memorandum on Lighting Fixture Disposal Guidance and Strategy in Appendix F of this Manual.)

(3) PCB storage. Areas used to store PCBs prior to disposal or reuse must meet the following criteria. The areas must:

(a) Be located above the 100-year floodplain.

(b) Be protected by roof and walls to prevent the infiltration of rainwater or runoff of PCB-contaminated materials.

(c) Have smooth, impervious flooring that does not have drains, cracks, or expansion joints.

(d) Have continuous curbing of a minimum 6-inch height sufficient to contain at least 25 percent of the volume of containers being stored.

(e) Have posted on the outside entrance of the facility or area the official PCB mark shown in 40 CFR §761.45.

e. Lead. New facility construction, modification, and renovation actions shall not use lead-based paints. Removal of lead-based paints shall be in accordance with the *EPA Program for the Management of Lead-Based Paint at EPA Facilities*. Refer to Chapter 4, paragraph 3, of this Manual.

f. Radon. Title II of the Toxic Substances Control Act, as amended by the Indoor Radon Abatement Act, provides for the monitoring of federal facility occupancies to determine radon concentrations. Radon concentrations identified above the EPA action level of 4 picocuries per liter (pCi/L) should be addressed through appropriate engineering and administrative controls. Radon in drinking water supplies, measured as combined radium-226 and radium-228, shall not exceed 5 pCi/L.

g. Asbestos. Asbestos operations and maintenance activities shall be performed in accordance with the *EPA Policy and Program for the Management of Asbestos-Containing Building Materials at EPA Facilities*.

7. Pesticides

a. Storage of Pesticides and Containers. Any facility storing pesticides classified as highly toxic or moderately toxic (40 CFR Part 165) and whose labels are required to bear the signal words "Danger," "Poison," or "Warning," or the skull and crossbones symbol should inventory and monitor its storage facilities even if application is performed by a licensed contractor. Pesticide storage areas shall be identified by signs placed on rooms, buildings, and fences to advise of the contents and warn of their hazardous nature. Signage on the outside of pesticide storage areas shall include "Danger," "Poison," or "Pesticide Storage," or use the NFPA 704 hazard classification system. Pesticide storage facilities should be designed with the following safeguards:

(1) Facilities should be dry, well-ventilated areas within a separate room, building, or covered area that is provided with fire protection.

(2) Eyewash and safety shower equipment should be available to users of the pesticide storage area. (See Chapter 4, paragraph 16, of this Manual for information on emergency equipment and showers.)

(3) Facilities should be protected by security measures such as locks and fences to prevent unauthorized entry.

(4) To prevent runoff of pesticides and pesticide-contaminated residues, facilities should have secondary containment systems such as dikes, berms, or other devices that are separate from the facility sanitary sewer or stormwater collection system.

(5) Where feasible, a wash basin should be present for collecting and containing wastewater from decontaminating pesticide application equipment.

(6) As EPA facilities operate integrated pest management programs, special attention shall be given to minimizing development of rodent warrens (nests, etc.) in areas such as garbage collection areas and dumpsters, and cafeterias.

b. Antifoulant Paints. Paints used on the exterior of EPA marine vessels may contain tributyltin (TBT) or other metal compounds that inhibit the growth of aquatic organisms such as algae and barnacles. All TBT antifouling paints shall meet the following conditions to minimize potential impacts on human health and the environment:

(1) Average daily release rate of 4.0 mg/organism/cm^2 per day or less.

(2) Not used on nonaluminum vessels that are less than 82 feet long (non-TBT paints must be used on these types of vessels).

(3) Classified as restricted pesticides (only sold to and applied by certified commercial applicators).

(4) Labeled in compliance with OSHA regulations.

Paints certified for such use are Chugoku Marine Paints, A.S. Seaflo Z-100LE; Sigma Coatings, 7293 Pilot LL Antifouling; and International Paints, Intersmooth Hisol SPC-AF. Updates and revisions to the list of certified paint manufacturers can be obtained by contacting the EPA Office of Pesticide Programs, Antimicrobial Program Branch at (703) 305-6661. Further, paints containing mercury shall not be used for interior finishes, as they are solely intended for exterior, antifoulant applications.

8. Radioactive Materials Management

a. General Design Considerations. Special considerations about where radioactive material will be used are addressed in the *Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels That Are As Low As Reasonably Achievable (ALARA)*, Pacific Northwest Laboratory (PNL-6577). In addition, regulations and associated guidance that will apply to the facility when it operates should be consulted. Design information that must be provided in license or permit applications should be reviewed to identify aspects of the design that are of particular interest to the Nuclear Regulatory Commission (NRC) or the Agreement State, as appropriate. Radioactive materials management activities on federal property are subject primarily to NRC oversight, whereas activities at nonfederal job sites are also subject to Agreement State standards. Consideration should also be given to configuring sample-receiving areas to accommodate the equipment to screen unknown samples for radiation contamination, as appropriate for the scope of facility operations. For a typical EPA laboratory facility, this information is available in NRC Regulatory Guide 10.7, *Guide for the Preparation of Applications for License for Laboratory and Industrial Use of Small Quantities of Byproduct Material*.

b. Control and Monitoring of Airborne Radionuclides. Extensive guidance on design of systems for controlling airborne radioactive material, both in the workplace and in

emissions from a facility, is available in the *Nuclear Air Cleaning Handbook*, Energy Research and Development Administration (ERDA) 76-21, and in Nuclear Power Plant Air Cleaning Units and Components, ANSI/American Society of Mechanical Engineers (ASME) N509.

c. Workplace Control and Monitoring. NRC requires the use of engineered controls (e.g., radioisotope fume hoods, glove boxes) as the primary means of protecting workers from exposure to airborne contaminants, including radioactive materials. Sealed sources generally require no special precautions. For the low concentrations of radioactive materials in powder or liquid form typically used at EPA facilities, the confinement afforded by a radioisotope laboratory fume hood will generally provide adequate control (see also Chapter 5, paragraph 12, of this Manual and Section 15 of the *AE&P Guidelines* for additional guidance). In general, airflow should always be from clean to contaminated areas, and ductwork and other components should include design features that minimize the potential for internal accumulation of radioactive materials as well as to facilitate decontamination. In some situations, the Radiation Safety Officer (RSO) may determine that radioactive materials used by the facility are of low enough radioactivity to be used safely within a conventional laboratory fume hood.

While NRC regulations do not prescribe a strict upper limit for airborne concentrations of radioactive material in the workplace, they do contain extensive requirements for workplace/individual monitoring and recordkeeping, if the potential exists for time-weighted concentrations to exceed specified levels. NRC rules also place additional restrictions, beyond those required by OSHA, on the use of individual respiratory protection as a compensatory measure. Accordingly, facility design should minimize the potential for worker exposure to airborne contaminants to ALARA levels.

d. Air Emissions. All EPA facilities that maintain NRC licenses must comply with 10 CFR Part 20, which contains requirements for limiting radioactive emissions to the public. Most EPA laboratories do not use sufficient quantities of radioactive material to require special emission control or monitoring equipment to meet established public radiation exposure limits in 10 CFR Part 20, Subpart D, beyond conventional laboratory engineering controls. Special use facilities or operations potentially handling significant quantities of radioactive materials should be evaluated on a case-by-case basis for specialized systems or controls necessary to fulfill established NRC limits in 10 CFR Part 20 or applicable license conditions.

e. Liquid Waste. NRC regulations in 10 CFR §20.2003 impose strict conditions on the discharge of radioactive materials to sanitary sewers. In designing a new facility, determination should be made as to whether the quantities and chemical and physical forms of liquid radioactive wastes can be disposed of in accordance with those regulations. If not, a liquid radioactive waste and mixed waste (see also paragraph 6 of this chapter) storage and treatment system must be provided. Facility design

should provide for segregation of radioactive waste, where practicable, from all other types of liquid wastes, particularly hazardous chemicals.

f. Solid Waste. Facilities that will use solid radioactive materials, other than sealed sources, should be provided with adequate space for temporary storage, packaging, monitoring, and preparing shipments to an authorized disposal facility. Provisions should be made for monitoring potentially contaminated waste prior to packaging so that contaminated and uncontaminated wastes can be segregated. Depending on the types and quantities of radioactive material used in the facility, shielding and/or physical access controls may be required for the solid waste storage area.

g. Access Control and Signage. NRC regulations contain requirements for "restricted areas." Restricted areas are defined as any area to which the facility licensee limits access for purposes of protecting individuals against undue risks from exposure to radiation or radioactive materials. Such areas, including waste storage facilities, shall be posted in accordance with the radiation caution signs specified in 10 CFR §20.1901 through §20.1903.

Activities with radioactive material shall be performed within an area where physical access can be controlled. Space may be required at the egress to the restricted area to facilitate monitoring of personnel or items for radioactive contamination. Additionally, more stringent regulatory requirements for controlling access to smaller areas within the restricted area may apply depending on the radiation levels and quantities and form of radioactive material. High-hazard facilities with containment provided within the laboratory shall consider using special engineering design features such as an airlock with interlocked doors or special air-monitoring and warning systems. Lockable cabinets are necessary for storing radioactive materials that are not in use. Design engineers must consult with individuals familiar with both the intended use of the facility and the applicable regulatory requirements to ensure that appropriate physical access controls are included in the design.

h. Shielding. Special shielding may be required to limit the radiation dose rates within the restricted area to levels consistent with EPA administrative limits for occupational radiation exposure and, outside of the restricted area, to levels specified in NRC regulations. Proper shield design requires knowledge of the maximum inventory of each isotope of radioactive material and where and how it will be used or stored in the facility. High-energy electronic radiation-generating devices may also require shielding. Detailed guidance on radiation shielding design is available in ANSI N43.3, standard on General Radiation Safety Installations Using Non-Medical X-ray and Sealed Gamma Ray Sources for Energies up to 10 MeV.

i. Contamination Control. Facilities where unsealed radioactive sources or material will be used should include design features to minimize the potential for contamination of surfaces with radioactive material and to facilitate decontamination. Construction materials and methods should be specified that minimize cracks,

crevices, and porous materials that can readily accumulate contamination. Work surfaces should be sealed, and seamless flooring rather than tiles should be considered. The standards contained in ANSI N512, Protective Coatings for Nuclear Applications, shall be considered.

j. Special Requirements for Mixed Wastes. Mixed low-level radioactive waste is regulated under both the NRC regulations and the hazardous waste management standards promulgated pursuant to the Resource Conservation and Recovery Act. Therefore, the storage and management of these wastes require consideration of design specifications in this paragraph and in paragraph 4 of this chapter.

9. Design for Environment

a. Environmental Planning under the National Environmental Policy Act (NEPA). The requirements under NEPA shall be met during EPA facility planning processes, as described below. Section 2 of the *AE&P Guidelines* contains the siting criteria to be used when developing a new laboratory. In developing or building a new laboratory, the requirements of NEPA and the siting criteria shall be given equal consideration.

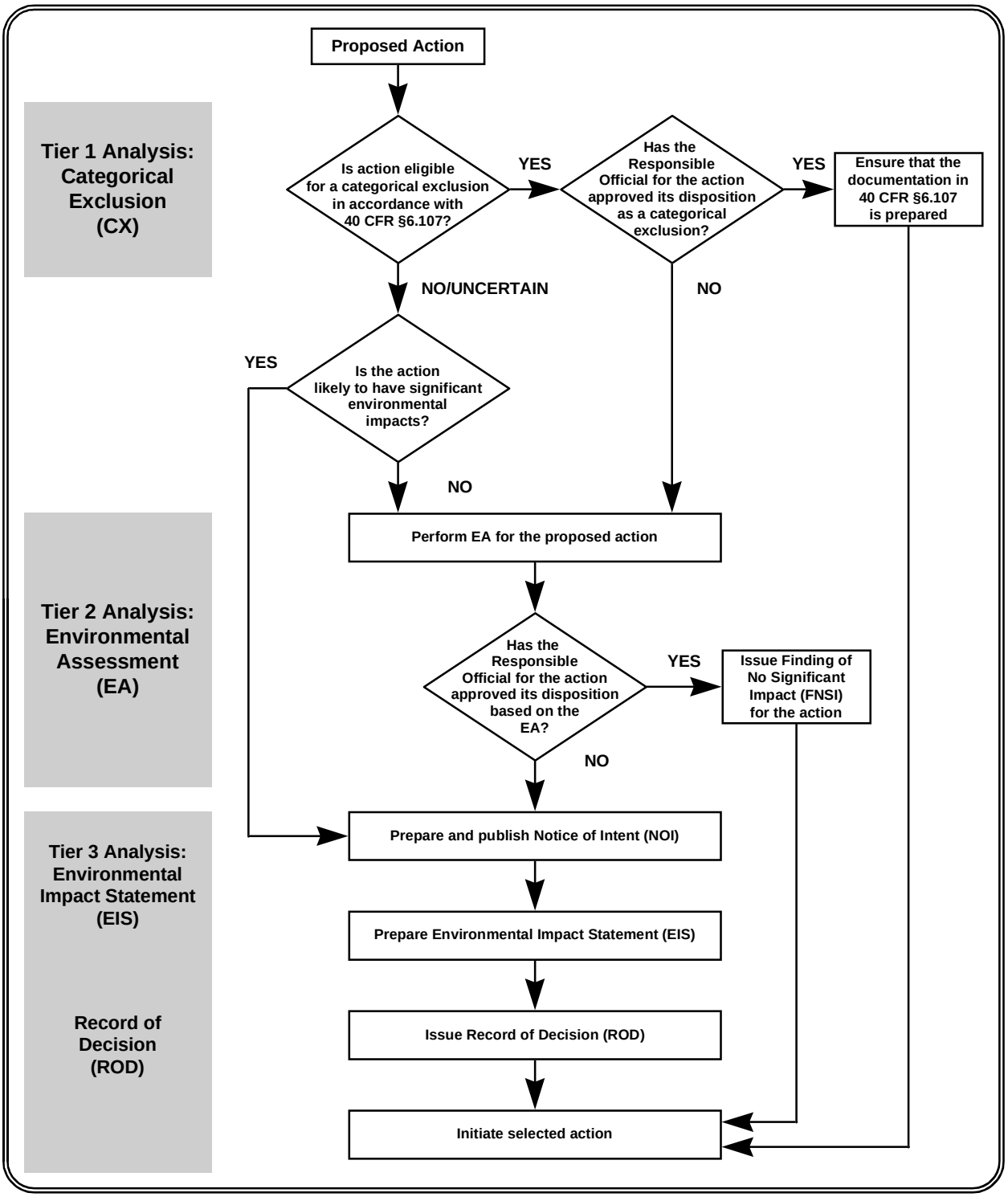
The purpose of NEPA is to ensure that environmental impacts and associated public concerns are systematically considered in making decisions on federal projects. NEPA requires an environmental evaluation by federal agencies prior to the execution of a proposed major federal action that could potentially have environmental impacts. Specific examples of actions that would require a NEPA review are construction-related activities, such as improvements or modifications to facilities, that could cause potential environmental effects.

The Council on Environmental Quality (CEQ) provides federal agencies with guidance on compliance with NEPA. In executing this task, CEQ promulgated NEPA regulations 40 CFR Parts 1500-1517 to accurately translate the intent of the NEPA statute into practical guidance for federal agencies. EPA's implementing regulations for NEPA are codified in 40 CFR Part 6. The *NEPA Review Procedures for EPA Facilities* focuses on the implementation of 40 CFR Part 6. The *NEPA Review Procedures for EPA Facilities* was developed by AEREB as an easy-to-use comprehensive guide that presents the requirements of 40 CFR Part 6 as well as specific EPA implementation procedures. It also contains specific information to assist the EPA project managers in integrating NEPA into facility management.

Figure 7-1 provides an overview of the NEPA process. The NEPA regulations identify three basic types of environmental impact reviews:

(1) Categorical Exclusion (CX)
(2) Environmental Assessment (EA)
(3) Environmental Impact Statement (EIS).

Figure 7-1. Overview of NEPA Process



Categorical exclusions are actions that normally do not require an EA or an EIS. These actions have minimal or no effect on environmental quality and pose no risk of causing environmentally significant changes to existing conditions. If a construction project falls under the CX criteria, it is exempt from further environmental impact reviews in accordance with 40 CFR §6.107. Such projects shall be reviewed by AEREB for approval. Documentation of a CX shall be executed and shall be maintained as part of the project file. A CX can be documented by completing page 1 of the EPA NEPA Review Form for Facility Alteration or Construction Project. The NEPA Review Form for Facility Alteration or Construction Project is contained in the *NEPA Review Procedures for EPA Facilities.*

Actions that may have an environmental impact, such as new construction or significant renovations, shall be evaluated through an EA. The purpose of an EA is to determine whether or not a proposed action may significantly affect the environment. If the results of an EA indicate no significant impact or that significant impacts can be effectively mitigated, EPA shall issue a Finding of No Significant Impact (FNSI), which may address measures to mitigate potential environmental impacts. The NEPA Review Form for Facility Alteration or Construction Project may be used to assist in determining the need for an EA and what information should be contained within an EA. The *NEPA Review Procedures of EPA Facilities* and the NEPA Review Form for Facility Alteration or Construction Project will lend assistance in preparing an EA and a FNSI.

The EIS process represents the most extensive level of NEPA analysis. As a result, EPA facility actions requiring the preparation of EISs are typically limited to larger construction projects that present the greatest likelihood for potentially significant impacts. The NEPA Review Form for Facility Alteration or Construction Project will assist in determining the need for an EIS. There are specific documentation and regulatory requirements that must be met in preparing an EIS. These requirements are thoroughly explained in the *NEPA Review Procedures for EPA Facilities.*

b. Sustainable Development. Using NEPA as an integral part of the planning process will assist AEREB and SHEMD in creating facilities that will conform to sustainable development practices. Other considerations in the sustainable development process include working within the development requirements of the local and state governments to ensure quality development. EPA facility siting and construction planning shall address all applicable local and state development requirements. This practice will help ensure harmonious interaction with the community and conformance with required local development practices.

c. Pollution Prevention. Pollution prevention opportunities exist in all aspects of facility management, including design and construction phases. EPA defines pollution prevention as source reduction and other practices that reduce or eliminate the creation of pollutants through increased efficiency in the use of raw materials, energy, water, and other resources, and protection of natural resources by

conservation. Executive Orders 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements; 12873, Federal Acquisition, Recycling, and Waste Prevention; and 12902, Energy Efficiency and Water Conservation at Federal Facilities drive current federal facility requirements for pollution prevention, affirmative procurement, and energy and water conservation.

Design for the environment addresses impacts throughout the building life cycle. Life cycle building design recognizes the environmental impacts of each stage of the facility's life cycle, from acquisition of raw materials through final disposal of demolition debris.

Extending the useful life of a building, equipment, or system can reduce environmental impacts by saving resources and generating less waste over time. Some of these attributes and their benefits are listed in Table 7-7.

Table 7-7. Examples of "Design for Environment" Benefits

Attribute	Benefit
Durability	Increase building's, equipment's, or system's ability to withstand wear, stress, and environmental degradation.
Adaptability	Reduce potential for the facility, equipment, or system to become obsolete by designing to facilitate updating or to perform multiple services.
Reliability	Maximize equipment and system reliability to extend lifetime and preclude health and safety problems.
Serviceability	Increase maintainability and repairability of equipment and systems to preclude early retirement and reduce environmental impacts.

(1) According to Executive Order 12873, the attributes listed in Table 7-7 should be considered during all aspects of facility management, from design, through the facility's active life, to closure. Accordingly, facility design and construction actions shall consider the following pollution prevention opportunities, where practicable:

(a) Use of materials such as fly ash–containing concrete and cement (section 401(b) of Executive Order 12873).

(b) Uses of finishes and coatings with low-VOC content.

(c) Use of structural fiberboard and laminated paperboard containing recovered materials (section 401(b) of Executive Order 12873).

(d) Modifications to paint spraying and thinning techniques.

(e) Use of environmentally preferred insulations, including those containing recovered materials (Section 401(b) of Executive Order 12873).

Sources for other design and construction processes and materials include the General Services Administration (GSA) Environmental Products Guide (Internet address http://www.gsa.gov), Department of Defense Green Products Catalogue, and EPA Design for the Environment fact sheets.

(2) In addition, repair and maintenance activities encompass opportunities for pollution prevention, including:

(a) Substitution of aqueous or less hazardous products for hazardous cleaning solvents.

(b) Replacement or retrofit of equipment (HVAC and fire suppression) containing ozone-depleting substances.

(c) Use of paint with low volatile organic content.

These actions will reinforce EPA's position as a leader in promoting pollution prevention.

d. Energy and Water Conservation. Design of new buildings, or retrofits of existing buildings, shall achieve the greatest level of energy and water conservation practicable. Building design shall consider the building in its entirety to provide a comprehensive understanding of the energy and water demands. The areas discussed below shall be evaluated for potential and current energy and water conservation opportunities in the design of new and existing buildings.

(1) Mission-related activities. The building design shall account for sophisticated technologies that may consume high levels of energy or water and that may also generate a significant amount of heat energy. Design shall include proper air circulation and ventilation, strategic placement of activities; and incorporation of innovative technologies, where appropriate, to promote resource conservation.

(2) Renewable resources. Where practicable, the building design shall incorporate renewable resource technologies (i.e., solar, wind, and water energy) to reduce overall energy and water demand. For buildings located in regions where there is abundant sunlight, solar technologies and effective building placement shall be considered in the design. In regions where the daytime temperature is high in the spring and summer, but low in the fall and winter, building design shall provide for natural shading, to the extent feasible, allowing for shade in the warmer seasons and access to the sunlight in the colder seasons.

(3) Energy-efficient technologies. Where practicable and commercially available, building designs shall incorporate energy- and water-efficient technologies. HVAC system design shall consider combinations of various technology

components where individual components contribute to the efficiency of the whole system (e.g., utilizing waste heat coming from a boiler to reheat cooled and dehumidified air). An example of a hybrid system could be a chiller system composed of technologies such as indirect evaporative cooling, heat pipes, boiler, chiller, absorber, and cooling tower, where each component benefits from another through cooling or heat transfer.

(4) Geographic location. Building design must fully account for the geographic conditions that may affect a building. Construction materials and technologies shall complement the given environmental elements in order to protect the building from harsh elements, therefore avoiding unnecessary energy and water usage. For buildings located in cold or hot climates, the functional design of the building must be assessed, including windows, walls, insulation, entryways, technical equipment, and building operation.